United States
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Agency

Economic Analysis for the Final Lead and Copper Rule Improvements

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List of Exhibits

List of Acronyms

µg/dL	micrograms per deciliter
µg/L	micrograms per liter
AALM	All Ages Lead model
ACS	American Community Survey
ADF	Average daily flow
ADHD	Attention-deficit/hyperactivity disorder
AHHS	American Healthy Homes Survey
AI	American Indian
AIC	Akaike's Information Criterion
AL	Action level
ALE	Action level exceedance
ANSI	American National Standards Institute
ANV	Alaska Native
ASDWA	Association of State Drinking Water Administrators
ATSDR	Agency for Toxic Substances and Disease Registry
AWIA	America's Water Infrastructure Act
AWWA	American Water Works Association
BIC	Bayesian information criterion
BIL	Bipartisan Infrastructure Law
BLL	Blood lead level
BLS	Bureau of Labor Statistics
CCR	Consumer Confidence Report
CCT	Corrosion control treatment
CCTV	Closed circuit television
CDC	Centers for Disease Control and Prevention
CED	Committee for Economic Development
CFR	Code of Federal Regulations
CFSAN	Center for Food Safety and Applied Nutrition
CHAD	Consolidated Human Activity Database
CI	Confidence interval
CND	Canada
CoSTS	Costs of State Transactions Study
CPI	Consumer price index
CVD	Cardiovascular disease
CWS	Community water system
CWSS	Community Water System Survey
DF	Design flow
DISC	Diagnostic Interview Schedule for Children
DMR	Discharge monitoring report
DSM	Diagnostic and Statistical Manual of Mental Disorders
DSSA	Distribution System and Site Assessment
DWINSA	Drinking Water Infrastructure Needs Survey and Assessment
DWM	Department of Water Management
DWSRF	Drinking Water State Revolving Fund
EA	Economic analysis

ECI	Employment cost index
ECTT	Error code tracking tool
EGLE	Environment, Great Lakes, and Energy
EJ	Environmental justice
EO	Executive order
EP	Entry point
EPA	United States Environmental Protection Agency
FDA	Food and Drug Administration
FIML	Full-information maximum likelihood
FR	Federal Register
FRFA	Final regulatory flexibility analysis
FRN	Federal Register Notice
FTE	Full-time equivalent
FY	Fiscal year
GCWW	Greater Cincinnati Water Works
GHG	Greenhouse gas
GI	Gastro-intestinal
GIS	Geographic information system
GM	Geometric mean
GRR	Galvanized requiring replacement
GU	Ground water under the direct influence of surface water (GU, shortened from GUDWI).
GW	Ground water
GWUDI	Ground water under the direct influence of surface water
HAB	Harmful algal blooms
HDPE	High-density polyethylene
HH	Households
HHS	Department of Health and Human Services
HMR	Heavy metals registry
HR	Hazard ratio
HRRCA	Health Risk Reduction and Cost Analysis
HUD	U.S. Department of Housing and Urban Development
ICR	Information collection request
ID	Identification
IEUBK	Integrated exposure uptake biokinetic
IPC	Internal plumbing code
IQ	Intelligence quotient
ISA	Integrated Science Assessment for Lead
LBW	Low birth weight
LCCA	Lead Contamination Control Act
LCR	Lead and Copper Rule
LCRI	Lead and Copper Rule Improvements
LCRMR	Lead and Copper Rule Minor Revisions
LCRR	Lead and Copper Rule Revisions
LCRWG	Lead and Copper Rule Working Group
LOD	Limit of detection
LSL	Lead service line
LSLR	Lead service line replacement

LT	Long-Term
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal
MDL	Method detection limit
mg/L	milligrams per liter
MGD	Million gallons per day
NACCHO	National Association of County and City Health Officials
NAICS	North American Industry Classification System
NCES	National Center for Education Statistics
NDWAC	National Drinking Water Advisory Council
NGO	Non-government organization
NHANES	National Health and Nutrition Examination Survey
NHEXAS	National Human Exposure Assessment Survey
NIH	National Institutes of Health
NPDES	National Pollutant Discharge Elimination System
NPDWR	National Primary Drinking Water Regulation
NPNCWS	Not-for-profit non-community water systems
NSF	NSF International
NTNCWS	Non-transient non-community water system
NTP	National Toxicology Program
NTTAA	National Technology Transfer and Advancement Act
OCCT	Optimal corrosion control treatment
OES	Occupational employment survey
OEWS	Occupational Employment and Wage Statistics
OGWDW	Office of Ground Water and Drinking Water
OIRA	Office of Information and Regulatory Affairs
O&M	Operation and maintenance
OMB	Office of Management and Budget
OWQP	Optimal water quality parameter
P90	Lead 90th percentile level
Pb	Lead
PE	Public education
PN	Public notice
POE	Point-of-entry
POU	Point-of-Use
PQL	Practical quantitation limit
PR	Puerto Rico
PRA	Paperwork Reduction Act
PSA	Public service announcement
PVC	Polyvinyl chloride
PWD	Philadelphia Water Department
PWS	Public water system
PWSID	Public water system identification number
PWSS	Public water system supervision
QA	Quality assurance
QC	Quality control
REML	Restricted maximum likelihood
RFA	Regulatory Flexibility Act

RLDWA	Reduction of Lead in Drinking Water Act
RTCR	Revised Total Coliform Rule
SAB	Science Advisory Board
SACCHO	State Associations of County and City Health Officials
SBA	Small Business Administration
SBAR	Small Business Advocacy Review
SBREFA	Small Business Regulatory Enforcement Fairness Act
SD	Standard deviation
SDWA	Safe Drinking Water Act
SDWIS	Safe Drinking Water Information System
SDWIS/Fed	Safe Drinking Water Information System/Federal version
SE	Standard error
SER	Small entity representatives
SHEDS	Stochastic Human Exposure and Dose Simulation
SISNOSE	Significant economic impact on a substantial number of small entities
SL	Service line
SLR	Service line replacement
SRF	State revolving fund
SS	Sums of squares
SW	Surface water
SYR3 ICR	Six-Year Review 3 Information Collection Request
TCR	Total Coliform Rule
TDS	Total Diet Study 2007-2013
TL	Trigger level
TLE	Trigger level exceedance
UCMR	Unregulated Contaminant Monitoring Rule
UMRA	Unfunded Mandates Reform Act
USA	United States of America
USD	United States Dollar
USEPA	Unites States Environmental Protection Agency
USGS	United States Geological Survey
USOMB	United States Office of Management and Budget
USPS	United States Postal Service
VLBW	Very low birth weight
VLS	Very large system
WBS	Work breakdown structure
WIC	Women, infants and children
WIFIA	Water Infrastructure Finance and Innovation Act
WIIN	Water Infrastructure Improvements for the Nation
WLL	Water lead levels
WPCA	Water Pollution Control Authority
WQP	Water quality parameter
WWTP	Wastewater treatment plant

Executive Summary

The final Lead and Copper Rule Improvements (LCRI) will significantly reduce the risk of exposure to lead from drinking water. The rule builds on the pre-2021 Lead and Copper Rule (LCR), which was promulgated in 1991 and last revised in 2007, and the 2021 Lead and Copper Rule Revisions (LCRR). The EPA conducted a review of the 2021 LCRR in accordance with Executive Order (EO) 13990 and announced its intention to strengthen the 2021 LCRR with this LCRI rulemaking. The final LCRI addresses the priorities the EPA identified in the 2021 LCRR review and public comments received on the proposed LCRI. The final rule includes strengthened requirements in priority areas and provides a fundamental shift to a more protective lead drinking water rule. In this rule, the agency is finalizing requirements for drinking water systems to replace lead and certain galvanized service lines. The final rule also removes the lead trigger level (TL), reduces the lead action level (AL) to 0.010 mg/L, and strengthens tap sampling procedures to improve public health protection and simplify implementation relative to the 2021 LCRR. Further, this final rule strengthens corrosion control treatment (CCT), public education and consumer awareness, requirements for small systems, and sampling in schools and child care facilities.

The final LCRI National Primary Drinking Water Regulation (NPDWR) is a significant regulatory action that was submitted to the Office of Management and Budget (OMB) for review. An economic analysis (EA) is required for all significant rules under EO 12866 (Regulatory Planning and Review), as amended by EO 14096. In addition, section 1412(b)(3)(C) of the Safe Drinking Water Act (SDWA) requires the EPA to prepare a Health Risk Reduction and Cost Analysis (HRRCA). This EA addresses these and other regulatory reporting requirements, including those that direct the EPA to conduct distributional and environmental justice analysis. With respect to the SDWA HRRCA requirements, section 1412(b)(3)(C)(i) lists the analytical elements of the required HRRCA as follows: (1) quantifiable and non-quantifiable health risk reduction benefits; (2) quantifiable and non-quantifiable health risk reduction benefits from reductions in co-occurring contaminants; (3) quantifiable and non-quantifiable costs that are likely to occur solely as a result of compliance; (4) incremental costs and benefits of rule options; (5) effects of the contaminant on the general population and sensitive subpopulations including infants, children, pregnant women, the elderly, and individuals with a history of serious illness; (6) any increased health risks that may occur as a result of compliance, including risks associated with co-occurring contaminants; and (7) other relevant factors such as uncertainties in the analysis and factors with respect to the degree and nature of the risk.

The entities potentially affected by the final LCRI are public water systems (PWSs) classified as either community water systems (CWSs) or non-transient non-community water systems (NTNCWSs) and primacy agencies (States). In the economic modeling performed, the EPA uses the Federal version of the Safe Drinking Water Information System (SDWIS/Fed) to derive the number of CWSs and NTNCWSs, 49,529 and 17,418, respectively. The agency also assumed, for modeling purposes, 56 primacy agencies.[1] In this EA, the EPA assumes that the final LCRI will be promulgated in 2024. The agency estimated the year or years in which all costs and benefits accrue over a 35-year period of analysis. The 35-year window was selected to capture costs associated with rule implementation as well as water systems

[1] The 56 primacy agencies include 49 States (excluding Wyoming), Puerto Rico, Guam, United States Virgin Islands, American Samoa, North Mariana Islands, and Navajo Nation. For cost modeling purposes, the EPA also included the District of Columbia (D.C.) as a primacy agency when assigning burden and costs of the rule although some of these costs are incurred by the actual primacy agency, EPA Region 3.

conducting service line replacement (SLR) and installing and operating optimal corrosion control treatment (OCCT).

The EPA annualized the estimated future streams of costs and benefits that accrue from compliance activities occurring over this same period of analysis symmetrically. The EPA does not capture the effects of compliance with the final LCRI after the end of the period of analysis, although, the agency does account for benefits that continue to accrue in the future from compliance activities that occur during the 35-year window. Costs and benefits are presented as annualized values in 2022 dollars. The EPA determined the present value of these costs and benefits using a discount rate of two percent as prescribed by the OMB Circular A-4 (OMB, 2023).

The EPA used its SafeWater LCR model to analyze the costs and benefits of the final LCRI. For a detailed description of the model, see Chapter 5 . PWSs will face different compliance scenarios depending on the size and type of the water system; the presence of lead, galvanized requiring replacement (GRR), and unknown service lines; water quality; and existing corrosion controls. In addition, PWSs will also face different unit costs based on water system baseline characteristics including size, type, and number of entry points (e.g., labor rates, and CCT capital and operation and maintenance unit costs).

One of the strengths of the SafeWater LCR model is that it incorporates a large degree of variability across water system baseline characteristics that influence compliance and costs. One limitation of the cost-benefit analysis is that the EPA does not have all of the PWS-specific data needed to fully reflect baseline and compliance variability across PWSs; therefore, the SafeWater LCR model applies a “model PWS” approach. The SafeWater LCR model creates model PWSs that represent systems in each, of 72 PWS categories, by combining the PWS-specific data available in SDWIS/Fed with data on baseline and compliance characteristics available at the PWS category level. When categorical data are point estimates, every model PWS in a category is assigned the same value. When the EPA has probabilistic data representing system variability, the SafeWater LCR model assigns each model PWS a value sampled from the distribution.

Chapter 3 describes in detail the baseline data elements, their derivations, and the inherent sources of uncertainty in the developed data elements. The EPA estimates the incremental costs and benefits of the final LCRI relative to a baseline, as described in Chapter 3, that assumes compliance with the 2021 LCRR and other State regulations requiring lead service line replacement (Illinois, Michigan, New Jersey, and Rhode Island) and tap sampling in schools and child cares (17 States and the District of Columbia) that go beyond the 2021 LCRR requirements.

As described in Chapter 4, the EPA determined it does not have enough information to perform a probabilistic uncertainty analysis as part of the SafeWater LCR model analysis for this rule. Instead, to capture uncertainty, the EPA estimated compliance costs (and benefits) by running the SafeWater LCR model under low and high bracketing scenarios. For costs, the bracketing scenarios are defined by the following three cost drivers:

1. Likelihood a model PWS will exceed the lead AL and/or TL under the 2021 LCRR and the AL under the final LCRI.
2. SLR unit costs.
3. CCT unit costs.

The low and high benefits bracketing scenarios are defined by the following benefits variables:

1. Likelihood a model PWS will exceed the AL and/or TL under the 2021 LCRR and the AL under the final LCRI (also used to define the low and high cost scenarios in the cost analysis).
2. The concentration-response functions that characterize how reductions in blood lead levels (caused by changes in lead exposure) translate into avoided intelligence quotient (IQ) reductions, cases of Attention-deficit/hyperactivity disorder (ADHD), and cardiovascular disease (CVD) premature mortality.
3. Two alternative low and high valuations for the ADHD cost of illness.

The EPA expects the significant portion of potential uncertainty is captured by this bracketing approach. However, some uncharacterized uncertainties still exist which may result in cost and benefit estimates that fall outside of the range of costs and benefits described in the bracketing model results. All significant limitations and uncertainties of this economic analysis are described in the following chapters, particularly sections 3.4, 4.2.2, and 5.7.

National Estimated Costs

In order to estimate the incremental national cost of the final LCRI, the EPA estimated the additional costs that PWSs, households, and States will incur in response to the final LCRI, above the cost they would face under the 2021 LCRR if the LCRI was not enacted. The EPA developed estimates of the LCRI regulatory requirement costs that accrue to PWSs for the following cost components: rule implementation and administration, sampling, service line inventory and replacement, CCT, point-of-use program (if a small system selects this compliance option), and public education and outreach. For each of these six categories of PWS cost the EPA also estimates State oversite costs. In Chapter 4, the EPA provides the data and algorithms used to calculate the cost of each activity that PWSs and States will undertake to comply with the final rule.

The EPA estimates that the final LCRI CCT requirements will result in systems adding orthophosphate to their finished water to creates a protective inner coating on pipes that can inhibit lead leaching. However, once phosphate is added to a public water distribution system, some of this incremental loading remains in the water stream as it flows into wastewater treatment plants (WWTPs) downstream. This generates treatment costs for certain WWTPs. Due to many water systems operating both the wastewater and drinking water systems, the EPA evaluated the costs of additional phosphate usage for informational purposes. Because these costs are associated with wastewater treatment to meet Clean Water Act regulatory requirements, they are not “likely to occur solely as a result of compliance” with the final LCRI, and, therefore, are not costs considered as part of the HRRCA under SDWA, section 1412(b)(3)(C)(i)(III).

Exhibit ES-1 provides the estimated incremental monetized costs of the final LCRI, for both the low and high scenarios, at a 2 percent discount rate, in millions of 2022 dollars.[2] Total annualized monetized incremental costs for the final LCRI range from $1.5 to $2.0 billion, in 2022 dollars discounted at 2 percent.

[2] Note that the incremental national costs of the final LCRI when compared to the pre-2021 LCR have also been computed and are provided in Appendix C.

Exhibit ES-1: Estimated National Annualized Monetized Incremental Costs of the Final LCRI at 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	LCRI	Incremental	Baseline	LCRI	Incremental
PWS Annual Costs						
Sampling	$134.0	$166.0	$32.0	$143.6	$176.2	$32.6
PWS SLR*	$84.6	$1,259.0	$1,174.4	$124.5	$1,763.9	$1,639.4
Corrosion Control Technology	$552.0	$591.1	$39.1	$647.8	$692.9	$45.1
Point-of Use Installation and Maintenance	$2.4	$5.1	$2.7	$5.9	$9.6	$3.7
Public Education and Outreach	$69.6	$267.3	$197.7	$72.1	$302.2	$230.1
Rule Implementation and Administration	$0.1	$3.4	$3.3	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$842.7***	***$2,291.9***	***$1,449.2***	***$994.1***	***$2,948.2***	***$1,954.1***
Household SLR Costs**	$8.1	$0.0	-$8.1	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$38.4	$66.1	$27.7	$41.8	$67.6	$25.8
Wastewater Treatment Plant Costs***	$3.0	$3.0	$0.0	$4.8	$5.1	$0.3
Total Annual Rule Costs	**$892.2**	**$2,361.0**	**$1,468.8**	**$1,067.1**	**$3,020.9**	**$1,953.8**

Acronyms: LCRI = Lead and Copper Rule Improvements; SLR = service line replacement; PWS = public water system; USD = United States dollars.

Notes: Previous baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.

*Service line replacement (SLR) includes full and partial lead service lines and galvanized requiring replacement service lines.

**The EPA in the 2021 LCRR economic analysis (USEPA, 2020) assumed that the cost of customer-side SLRs made under the goal-based replacement requirement would be paid for by households. The agency also assumed that system-side SLRs under the goal-based replacement requirement and all SLRs (both customer-side and systems-side) would be paid by the PWS under the 3 percent mandatory replacement requirement. The EPA made these modeling assumptions based on the different levels of regulatory responsibility systems faced operating under a goal-based replacement requirement versus a mandatory replacement requirement. While systems would not be subject to a potential violation for not meeting the replacement target under the goal-based replacement requirement, under the 3 percent mandatory replacement requirement the possibility of a violation could motivate more systems to meet the replacement target even if they had to adopt customer incentive programs that would shift the cost of replacing customer-side service lines from customers to the system. To be consistent with these 2021 LCRR modeling assumptions, under the final LCRI, the EPA assumed that mandatory replacement costs would fall only on systems. Therefore, the negative incremental values reported for the "Household SLR Costs" category do not represent a net cost savings to households. They represent an assumed shift of the estimated SLR costs from households to systems. The EPA has insufficient information to estimate the actual SLR cost sharing relationship between customers and systems at the national level of analysis.

***Due to many water systems operating both the wastewater and drinking water systems, the EPA is evaluating the costs of additional phosphate usage for informational purposes. These costs are not "likely to occur solely as a result of compliance" with the final LCRI, and therefore are not costs considered as part of the Health Risk Reduction and Cost Analysis (HRRCA) under the Safe Drinking Water Act (SDWA), section 1412(b)(3)(C)(i)(III).

The final LCRI is expected to result in additional phosphate being added to drinking water to reduce the amount of lead leaching into the water in the distribution system. Although the downstream ecological impacts are not costs considered as part of the HRRCA under the SDWA, section 1412(b)(3)(C)(i)(III), the EPA, for informational purposes, has quantified incremental phosphorus loadings and outlined potential downstream ecological impacts. The EPA estimated that, nationwide, the final LCRI may result in post WWTP total incremental phosphorus loads to receiving waterbodies increasing over the period of analysis, under the low and high scenarios, by a range of 225,000 to 272,000 pounds fifteen years after promulgation, and by a range of 216,000 to 260,000 pounds at Year 35. At the national level, under the high scenario, this additional phosphorus loading to waterbodies is relatively small, less than 0.03 percent of the total phosphorous load deposited annually from all other anthropogenic sources. However, national average national average receiving waterbody phosphorous load impacts may obscure significant localized ecological impacts. Impacts, such as eutrophication, may occur in water bodies without restrictions on additional phosphate loadings, or in locations with existing elevated phosphate levels.

The EPA also notes that there exist unquantified costs associated with SLR. Costs associated with the disruption of normal traffic patterns in communities implementing SLR programs are not accounted for in the monetized cost estimates of the rule. This impact to traffic could be significant in localized areas where lead, GRR, and unknown service lines are co-located with high traffic roads. During SLR worksite activities and characteristics have the potential to increase car and pedestrian accidents. Also given the necessity to shut off water service to buildings and residences during SLR the probability of fire damage and negative health/sanitation impacts may increase.

National Estimated Benefits

Estimated benefits, in terms of health risk reduction from the final LCRI, result from the activities performed by water systems, which are expected to reduce risk to the public from exposure to lead and copper in drinking water at the tap. The EPA quantifies and monetizes some of this health risk reduction from lead exposure by estimating the decrease in lead exposures accruing to both children and adults from the installation and re-optimization of OCCT, SLR, the implementation of point-of-use filter devices, and the provision of pitcher filters in systems with multiple action level exceedances and by quantifying and monetizing the resulting increases in IQ in children zero to seven years old, ADHD in older children, reductions in incidents of low birth weight, and adult CVD premature mortality. For a detailed discussion of the estimation of national incremental annualized benefits see Chapter 5.

Total estimated incremental monetized annualized benefits for these four health endpoints range from $13.5 to $25.1 billion, in 2022 dollars discounted at a 2 percent discount rate. See Exhibit ES-2 for additional detail.

Exhibit ES-2: Estimated National Annualized Monetized Benefits of the Final LCRI at 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	LCRI	Incremental	Baseline	LCRI	Incremental
Annual Child Cognitive Development Benefits	$1,208.5	$6,831.3	$5,622.8	$3,279.0	$10,963.0	$7,684.0
Annual Low-Birth Weight Benefits	$1.0	$5.4	$4.4	$1.8	$5.7	$3.9
Annual ADHD Benefits	$33.6	$196.3	$162.7	$179.9	$599.5	$419.6
Annual Adult CVD Premature Mortality Benefits	$1,750.7	$9,454.3	$7,703.6	$8,174.9	$25,210.0	$17,035.1
Total Annual Benefits	**$2,993.8**	**$16,487.3**	**$13,493.5**	**$11,635.6**	**$36,778.2**	**$25,142.6**

Acronyms: ADHD = Attention-Deficit/Hyperactivity Disorder; CVD = cardiovascular disease; LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

While the EPA is not required by SDWA 1412(b)(3)(C)(i)(III) to consider climate disbenefits under the HRRCA, the agency has estimated, solely for the purpose of complying with EO 12866, the potential climate disbenefits caused by increased greenhouse gas (GHG) emissions associated with the operation of CCT at drinking water treatment facilities and the use of construction and transport vehicles in the replacement of lead and GRR service lines. The estimated monetized annualized disbenefits range from $2.1 million under the low scenario to $2.0 million under the high scenario discounted at 2 percent, in 2022 dollars.

In addition to the monetized benefits of the final LCRI, there are several other benefits that are not quantified. The EPA focused its non-quantified impacts assessment on the endpoints identified using two comprehensive United States Government documents summarizing the literature on lead exposure health impacts. These documents are the EPA's Integrated Science Assessment for Lead (ISA) (USEPA, 2024), and the United States Department of Health and Human Services' National Toxicology Program (NTP) Monograph on Health Effects of Low-Level Lead (NTP, 2012). The risk of adverse health effects due to lead exposure that are expected to decrease as a result of the final LCRI are summarized in Appendix D and are expected to affect both children and adults. These endpoints include CVD morbidity effects, renal effects, reproductive and developmental effects (apart from ADHD and low birth weight initial hospitalization), immunological effects, neurological effects (apart from children's IQ), and cancer.

There are a number of final LCRI requirements that reduce lead exposure to both children and adults that the EPA could not quantify. New public education and expanded service line inventory information requirements will lead to additional averting behavior on the part of the exposed public, resulting in reductions in the negative impacts of lead.

The EPA did not quantify the CCT benefits of reduced lead exposure from lead-containing plumbing components (not including from lead and/or GRR service lines) to individuals who reside in both: 1) homes that have lead and/or GRR service lines but also have other lead-containing plumbing components, and 2) those that do not have lead and/or GRR service lines but do have lead-containing plumbing components.[3] The EPA has determined that the final LCRI requirements may result in reduced lead exposure to the occupants of both these types of buildings as a result of improved monitoring and additional actions to optimize CCT. In the analysis of the LCRI, the number of both homes served by lead and/or GRR service lines and homes not served by lead and/or GRR service lines potentially affected by water systems increasing their corrosion control during the 35-year period of analysis is 5.2 million in the low scenario and 9.1 million in the high scenario. Some of these households may have leaded plumbing materials apart from lead or GRR service lines, including lead connectors, leaded brass fixtures, and lead solder. These households could potentially see reductions in tap water lead concentrations. Also, because of the lack of granularity in the lead tap water concentration data available to the EPA for the regulatory analysis, the benefits of small improvements in CCT to individuals residing in homes with lead content service lines, like those modeled under the Distribution System and Site Assessment requirements, are not quantified.

Non-quantified cobenefits also exist when the corrosion inhibitors used by systems that are required to install or re-optimize CCT as a result of the final LCRI result in increased useful life of the plumbing components and appliances (*e.g.*, water heaters), reduced maintenance costs, reduced treated water loss from the distribution system due to leaks, and reduced potential liability and damages from broken pipes in buildings that receive treated water from the system (Levin, 2023). The replacement of GRR service lines may also lead to reduced treated water loss from the distribution system due to leaks (AwwaRF and DVGW-Technologiezentrum Wasser, 1996).

Additionally, the risk of adverse health effects associated with copper that are expected to be reduced by the final LCRI are summarized in Appendix E. These risks include acute gastrointestinal symptoms, which are the most common adverse effect observed among adults and children. In sensitive groups, there may be reductions in chronic hepatic effects, particularly for those with rare conditions such as Wilson's disease and children predisposed to genetic cirrhosis syndromes. These diseases disrupt copper homeostasis, leading to excessive accumulation that can be worsened by excessive copper ingestion (NRC, 2000).

Comparison of Nation Costs and Benefits

Exhibit ES-3 compares the estimated annualized monetized incremental costs and the estimated annualized monetized incremental benefits of the final LCRI at a 2 percent discount rate; the monetized net annualized incremental benefits range from $12.0 billion to $23.2 billion.

[3] Although the EPA estimated an average lead concentration for the first 10 liters of drinking water to inform the water lead concentration estimates used to quantify benefits the EPA could not calculate the CCT benefits associated with lead containing plumbing components (apart from lead and/or LSL/GRR service lines), because the EPA used a pooled estimate for all CCT conditions in residences with no lead and/or LSL/GRR service lines in place (See Chapter 5, section 5.2.3 for additional information).

Exhibit ES-3: Comparison of Estimated Monetized National Annualized Incremental Costs to Benefits of the LCRI - 2 Percent Discount Rate (millions 2022 USD)

	Low Scenario	High Scenario
Annualized Incremental Costs	$1,468.8	$1,953.8
Annualized Incremental Benefits	$13,493.5	$25,142.6
Annual Net Benefits	**$12,024.7**	**$23,188.8**

Acronyms: LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

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1 Introduction

Exposure to lead can cause harmful health effects for people of all ages, especially pregnant people, infants, and young children (CDC, 2022a; CDC, 2022b; CDC, 2023). Lead has acute and chronic impacts on the body. Lead exposure causes damage to the brain and kidneys and can interfere with the production of red blood cells that carry oxygen to all parts of the body (ATSDR, 2020). Developing fetuses, infants, and young children are most susceptible to the harmful health effects of lead (ATSDR, 2020). Exposure to lead is known to present serious health risks to the brain and nervous system of children (USEPA, 2013; USEPA, 2024a). Young children and infants are particularly vulnerable to the physical, cognitive, and behavioral effects of lead due to their sensitive developmental stages. There is no known safe level of exposure to lead. Scientific studies have demonstrated that there is an increased risk of health effects in children even when their blood lead levels are less than 3.5 micrograms per deciliter (CDC, 2022c) and in adults even when blood lead levels are less than 10 micrograms per deciliter (NTP, 2012). Low-level lead exposure is of particular concern for children because their growing bodies absorb more lead than adults do, and their brains and nervous systems are more sensitive to the damaging effects of lead (ATSDR, 2020). Sources of lead include, but are not limited to, lead-based paint, drinking water, and soil contaminated by historical sources.

The U.S. Environmental Protection Agency (EPA) has taken several steps over the past 40 years to reduce lead exposure through drinking water. To reduce the amount of lead in plumbing materials, Congress prohibited the use or introduction into commerce of pipes and pipe fittings and fixtures that contained more than 8 percent lead as well as solder or flux that contained more than 0.2 percent of lead in 1986. Up until that time, lead was widely used in plumbing materials. Because lead service lines (LSLs) were typically constructed with a maximum diameter of two inches (LSLR Collaborative, n.d.), it is highly unlikely that there are lead water mains. Water mains are typically 6 to 16 inches in diameter, whereas service lines have a smaller diameter. The common water main materials include ductile iron, polyvinyl chloride (PVC), asbestos cement, high-density polyethylene (HDPE), and concrete steel (Folkman, 2018).

The EPA estimates there are about 9.0 million LSLs in communities nationwide (USEPA, 2024b) in addition to potentially millions of older buildings with lead solder and faucets that contain lead. In 2011, Congress passed the Reduction of Lead in Drinking Water Act (RLDWA) revising the definition of lead free by lowering the maximum lead content of the wetted surfaces of plumbing products (such as pipes, pipe fittings, plumbing fittings and fixtures) from 8 percent to a weighted average of 0.25 percent, establishing a statutory method for the calculation of lead content. On September 1, 2020, the EPA published the final rule: *Use of Lead Free Pipes, Fittings, Fixtures, Solder, and Flux for Drinking Water* that made conforming changes to regulations consistent with the RLDWA and which also requires that manufacturers or importers certify that their products meet the requirements using a consistent verification process (USEPA, 2020).

The EPA first promulgated a National Primary Drinking Water Regulation (NPDWR) for Lead and Copper (LCR) in 1991 (56 FR 26460; USEPA, 1991). The LCR is a treatment technique rule that requires systems to monitor drinking water at customer taps. If lead concentrations exceed an action level of 0.015 milligrams per liter (mg/L) or copper concentrations exceed an action level of 1.3 mg/L in more than 10 percent of customer taps sampled (90^{th} percentile level), the LCR required systems to undertake

corrosion control treatment (CCT) steps. Following a lead action level exceedance, the LCR also required the system to inform the public about steps they should take to protect their health and replace LSLs after installing CCT and/or source water treatment. On January 12, 2000, the EPA promulgated Minor Revisions to the LCR (LCRMR) (65 FR 1950; USEPA, 2000). These Minor Revisions streamlined the LCR, promoted consistent national implementation, and reduced the reporting burden on affected entities. The EPA promulgated the Short-Term Revisions in 2007 to improve implementation of the rule (72 FR 57782; USEPA, 2007). For additional information on the EPA's statutory and regulatory actions related to the LCR, refer to Chapter 2, Section 2.1. The EPA is also committed to assisting schools and child care facilities with testing for lead in drinking water through the *3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities: A Training, Testing, and Taking Action Approach (Revised Manual)* (USEPA, 2018).

On January 15, 2021, the EPA published in the *Federal Register* the ''National Primary Drinking Water Regulation: Lead and Copper Rule Revisions'' (86 FR 4198; USEPA, 2021a) (2021 LCRR) with an effective date of March 16, 2021, and a compliance date of January 16, 2024. The 2021 LCRR sought to better identify areas with the greatest potential for lead contamination, strengthen CCT requirements, accelerate and strengthen lead service line replacement (LSLR), expand consumer awareness and improve risk communication, and require systems to offer lead-in-water testing and public education in schools and child care facilities. On June 16, 2021, the EPA published the agency's decision to delay the effective and compliance dates of the 2021 LCRR (86 FR 31939; USEPA, 2021b) to allow time for the EPA to review the rule in accordance with Presidential directives issued on January 20, 2021 (Executive Order 13990) and conduct important consultations with affected parties. Based on this review, the EPA decided to proceed with developing a rule, known as the Lead and Copper Rule Improvements (LCRI), that would revise certain key sections of the 2021 LCRR while allowing the rule to take effect. In the 2021 LCRR review, the EPA noted that it does not intend to make any changes to the initial inventory requirements in the LCRI. Additionally, the review highlighted other nonregulatory actions outside of the Safe Drinking Water Act (SDWA) framework to reduce exposure to lead in drinking water, including funding, targeted technical assistance, and risk communication tools.

The December 2021 Biden-Harris Lead Pipe and Paint Action Plan presented a multi-agency effort with a goal of replacing all lead pipes over the following decade and providing support to local communities for lead paint removal (The White House, 2021). The development of a final NPDWR, the LCRI, is a key action of the Lead Pipe and Paint Action Plan. The aim of the plan is to mobilize resources from across the federal government through funding made available from the Infrastructure Investment and Jobs Act, also referred to as the Bipartisan Infrastructure Law (BIL), to reduce lead exposure from pipes and paint containing lead. The BIL invested an unprecedented $50 billion in the nation's water and wastewater infrastructure, including $15 billion dedicated to LSLR. The plan includes a goal of replacing all LSLs in the nation and remediating lead paint.

In October 2022, the EPA published the *Strategy to Reduce Lead Exposures and Disparities in U.S. Communities* (or "Lead Strategy") to "advance EPA's work to protect all people from lead with an emphasis on high-risk communities" (USEPA, 2022). This agency-wide Lead Strategy promotes environmental justice in communities challenged with lead and includes four key goals: (1) reduce community exposures to lead sources; (2) identify communities with high lead exposures and improve their health outcomes; (3) communicate more effectively with stakeholders; and (4) support and conduct critical research to inform efforts to reduce lead exposures and related health risks. The

development of the LCRI is a key action within the EPA's Lead Strategy and "reflects EPA's commitment to fulfilling the Biden-Harris Administration's historic commitment of resources to replace lead pipes and support lead paint removal under the Lead Pipe and Paint Action Plan" (USEPA, 2022).

On December 6, 2023, the EPA published in the *Federal Register* the proposed regulation, ''National Primary Drinking Water Regulations for Lead and Copper Rule Improvements'' (88 FR 84878; USEPA, 2023a). The proposal included advancements in protecting people from the health effects from exposures to lead in drinking water. These advancements are based on the science and existing practices utilized by drinking water systems. Key provisions in the proposal include requiring the vast majority of all water systems across the country to replace lead and galvanized requiring replacement (GRR) service lines regardless of lead levels within 10 years, locating legacy lead pipes, improving tap sampling, lowering the lead action level, and strengthening protections to reduce exposure. The EPA proposed to retain the 2021 LCRR requirements, and associated October 16, 2024 compliance date, for the initial service line inventory, notifications to consumers served by a lead, GRR, or lead status unknown service lines, Tier 1 public notification of a lead action level exceedance, and associated reporting requirements.

The final LCRI addresses the priorities the EPA identified in the 2021 LCRR review, including the equitable replacement of all LSLs in the nation, better identification of where LSLs are and action in communities most at risk of lead exposure, and streamlined and improved implementation of the rule. This final LCRI is the culmination of numerous meaningful consultations and engagements over several years, including during the 2021 LCRR review, and in stakeholder outreach conducted to inform the development of the proposed and final LCRI, along with almost 200,000 public comments submitted to the docket for the proposed LCRI.

This economic analysis (EA) presents the evaluation of the benefits and costs of the final LCRI. The analysis is performed in compliance with Executive Order 12866, *Regulatory Planning and Review* (58 FR 51735, October 4, 1993), as amended by Executive Order 14094 (88 FR 21879, April 6, 2023), *Modernizing Regulatory Review*. These executive orders require the EPA to estimate the economic impact of rules that have an annual effect on the economy of over $200 million, to make that analysis available to the public for comment prior to publication of the final rule, and to consider ways to reduce regulatory burden and maintain flexibility for the public. In addition, SDWA requires the EPA Administrator to "publish and seek public comment on an analysis of the health risk reduction benefits and costs likely to be experienced as the result of compliance with the treatment technique and alternative treatment techniques that are being considered . . ." (SDWA section 1412(b)(3)(C)(ii)). The EPA solicited public comment on all aspects of the data and analysis presented in the proposed EA and associated Appendices as part of the public commenter period on the proposed LCRI.

This chapter provides a summary of the final LCRI in Section 1.1, outlines the organization of this EA in Section 1.2, and provides information regarding supporting calculations and citations in Section 1.3.

1.1 Summary of the Final LCRI

The final LCRI will significantly reduce the risk of exposure to lead from drinking water. The rule builds on the pre-2021 LCR (promulgated in 1991 and last revised in 2007) and the 2021 LCRR. The LCRI addresses the priorities the EPA identified in the 2021 LCRR review and public comments received on

the proposed LCRI. The final rule includes strengthened elements of the rule in priority areas and provides a fundamental shift to a more protective lead drinking water rule. The LCRI focuses on the following key areas:

1. **Achieving Lead Pipe Replacement within 10 Years**. The final LCRI requires mandatory full service line replacement of lead and GRR service lines under the control of the system within 10 years unless the State[4] sets a shortened deadline or the State approves a deferred deadline for those systems that are eligible. The final LCRI retains the requirement for systems to replace lead connectors when encountered and updates the requirements to develop a service line replacement plan.

2. **Locating Legacy Lead Pipes**. Knowing where lead pipes are located is critical to replacing them efficiently and equitably. Under the final LCRI, all water systems are required to identify the material of all service lines by the mandatory service line replacement deadline. Water systems are required to make their service line inventories publicly available and to regularly update them. In addition, water systems must use a validation process to ensure the service line inventory is accurate. Water systems are also required to track lead connectors in their inventories and replace them as they are encountered.

3. **Improving Tap Sampling**. The final LCRI makes key changes to the protocol that water systems must use for tap sampling informed by best practices already being deployed at the local and State level. Water systems are required to collect first- and fifth-liter samples at sites with LSLs and use the higher of the two values when determining compliance. This method will better represent water that has been stagnant both within the LSL and the premise plumbing, helping water systems better understand the effectiveness of their CCT.

4. **Lowering the Lead Action Level**. The final LCRI lowers the lead action level from 0.015 mg/L to 0.010 mg/L. When a water system's lead sampling exceeds the action level, water systems are required to inform the public and take actions associated with CCT and public education that will reduce lead exposure, while concurrently working to replace all lead and GRR service lines. For example, the system may be required to install or adjust CCT to reduce lead that leaches into drinking water. While lowering the lead action level requires systems to take actions to reduce lead exposure sooner, the EPA also emphasizes the many final rule requirements will result in additional public health benefits irrespective of systemwide lead levels, recognizing there is no safe level of lead in drinking water, including full service line replacement and other public education provisions.

5. **Strengthening Protections to Reduce Exposure**. The final LCRI requires water systems with continually high lead levels to conduct additional outreach to consumers and make filters certified to reduce lead available to all consumers. These additional actions can reduce consumer exposure to higher levels of lead in drinking water while the water system works to

[4] State means the agency of the State or Tribal government that has jurisdiction over public water systems. During any period when a State or Tribal government does not have primary enforcement responsibility pursuant to Section 1413 of the Public Health Service Act (as amended by the Safe Drinking Water Act, Public Law 93–523), the term "State" means the Regional Administrator, U.S. Environmental Protection Agency (40 CFR §141.2).

reduce systemwide lead levels (*e.g.*, achieving 100 percent lead and GRR service line replacement, installation or re-optimization of optimal corrosion control treatment (OCCT)), which may take years to fully implement.

Exhibit 1-1 compares the major differences among the pre-2021 LCR, the 2021 LCRR, and the final LCRI. In general, only the changes among the pre-2021 LCR, the 2021 LCRR, and the final LCRI are shown in the exhibit. Asterisks (*) in the pre-2021 LCR and 2021 LCRR columns denote requirements that are retained in the final LCRI, and these requirements are, therefore, not repeated in the final LCRI column.

Exhibit 1-1: Comparison of the 2021 LCRR, Proposed LCRI, and Final LCRI Requirements

Pre-2021 LCR	2021 LCRR	Final LCRI
Service Line Inventory		
• Systems were required to complete a materials evaluation by the time of initial sampling. • No requirement to regularly update materials evaluation.	• All systems must develop an initial lead service line (LSL) inventory by October 16, 2024, that includes all service lines, regardless of ownership, categorized as lead, non-lead, galvanized requiring replacement (GRR), and unknown.* • The inventory must be made publicly accessible and available online for systems serving > 50,000 persons.* • The publicly available inventory must include a locational identifier for each lead and GRR service line. • The LSL inventory must be updated based on the system's tap sampling frequency but no more than annually.	• All systems must review specified information that describes connector materials and locations. • Systems must include each identified connector in their baseline inventory by the Lead and Copper Rule Improvements (LCRI) compliance date. • Connector material categories include lead, non-lead, unknown, and no connector present. • The inventory must include a street address with each service line and connector, if available. • The inventory must be updated annually. • Systems must include in their inventories the total number of each type of service line, the number of lead and unknown connectors, the number of full lead and GRR service line replacements, and the number of partial lead and GRR service line replacements. • Systems must respond to customer inquiries on incorrect material categorizations within 60 days. • Systems must validate the accuracy of their methods to categorize non-lead service lines in their inventory no later than 7 years after the compliance date by the end of the calendar year unless on a shortened or deferred deadline. ○ The validation pool includes all non-lead service lines except for those installed after the applicable Federal, State, or local lead ban, visually inspected at a

Pre-2021 LCR	2021 LCRR	Final LCRI
		minimum of two points on the pipe exterior, or previously replaced. ○ Systems may submit previous validation efforts in lieu of the LCRI requirements if they are at least as stringent as the requirements, and States must review and approve of these previous efforts. • Systems must identify all unknown service lines by their mandatory service line replacement deadline.
Service Line Replacement		
Replacement Plan • No requirement.	**Replacement Plan** • All systems with at least one lead, GRR, or unknown service line must develop a lead service line replacement (LSLR) plan by the compliance date. • The plan must include a strategy to prioritize service line replacement.*	**Replacement Plan** • All systems with at least one lead, GRR, or unknown service line must develop the service line replacement plan by the compliance date. The plan includes the elements from the Lead and Copper Rule Revisions (LCRR) as well as two new elements: (1) a strategy to inform customers and consumers about the plan and replacement program and (2) an identification of any legal requirements or water tariff agreement provisions that affect a system's ability to gain access to conduct full service line replacement.* • The service line replacement plan must include additional plan elements if the system has at least one lead-lined galvanized service line or if the system is eligible for a deferred deadline. • Service line replacement plan must be publicly accessible; and available online for systems serving > 50,000 persons. • The plan must be updated annually to include any new or updated information and submitted to the State on an annual basis.

Pre-2021 LCR	2021 LCRR	Final LCRI
		• By the compliance date, systems eligible for and planning to use deferred deadlines must include in the plan information on what the system identifies as the earliest deadline and fastest feasible rate to replace lead and GRR service lines that is no slower than 39 annual replacements per 1,000 service connections. • By the end of the second program year, the State is required to determine in writing whether a system with a deferred deadline is replacing lead and GRR service lines at the fastest feasible rate, either by approving the continued use of that deferred deadline or by setting the fastest feasible rate for the system. In addition to annual updates, systems with deferred deadlines must submit their plan every three years with updated information about why the replacement rate is still the fastest feasible. The State must review this information and determine in writing if the system with a deferred deadline is still replacing lead and GRR service lines at the fastest feasible rate, either by approving the continued use of that deferred deadline or by setting the fastest feasible rate.
Lead Service Line Replacement • Replacement program requirements are based on the 90th percentile (P90) lead level, corrosion control treatment (CCT) installation, and/or source water treatment. • Systems conducting LSLR must annually replace at least 7 percent of LSLs in their distribution system. • Systems must replace the LSL portion they own and offer to replace the private portion. Systems are not required to bear the cost of replacing the private portion.	**Lead Service Line Replacement** • Replacement program requirements are dependent on P90 lead level for community water systems (CWSs) serving > 10,000 persons: ○ If P90 > 0.015 mg/L: Must fully replace 3 percent of lead and GRR service lines per year based upon a 2-year rolling average (mandatory replacement) for at least 4 consecutive 6-month monitoring periods.	**Service Line Replacement** • Replacement program requirements are independent of systems' P90 lead levels. • All CWSs and NTNCWSs with one or more lead, GRR, or unknown service line in their inventory must replace lead and GRR service lines under their control within 10 years, unless subject to a shortened or deferred deadline. • Systems must replace service lines at a cumulative average replacement rate of 10

Pre-2021 LCR	2021 LCRR	Final LCRI
• Full LSLR, partial LSLR, and LSLs with lead sample results ≤ 0.015 mg/L ("test-outs") count toward the 7 percent replacement rate. • Systems can discontinue LSLR after 2 consecutive 6-month monitoring periods at or below the lead action level. • Requires replacement of LSLs only (*i.e.*, no GRR service lines).	○ If P90 > 0.010 mg/L but ≤ 0.015 mg/L: Implement a goal-based LSLR program and consult the primacy agency (or State) on replacement goals for 2 consecutive 1-year monitoring periods. • CWSs serving ≤ 10,000 persons and all non-transient, non-community water systems (NTNCWSs) that select LSLR as their compliance option must complete LSLR within 15 years if P90 > 0.015 mg/L. See the *Small System Flexibility* section of this exhibit. • Annual LSLR rate is applied to the number of lead and GRR service lines when the system first exceeds the trigger or action level plus the number of unknown service lines at the beginning of the year. • Only full LSLR (replacement of the entire length of the service line) counts toward mandatory rate* and goal-based rate. • All systems must replace their portion of an LSL if notified by consumer of private side replacement within 45 days of notification of the private replacement. If the system cannot replace the system's portion within 45 days, it must notify the State and replace the system's portion within 180 days.* • Following each service line replacement, systems must: ○ Provide pitcher filters or point-of-use devices and 6 months of replacement cartridges to each customer after replacement.* ○ Provide pitcher filters and cartridges before the affected portion of the line or the fully replaced service line is returned to service.*	percent, unless subject to a shortened or deferred deadline. • Cumulative average replacement rate is applied to the total number of unknown, lead, and GRR service lines in the baseline inventory minus the number of unknown service lines that have been determined to be non-lead since the baseline inventory. • Systems that would have to annually replace more than 39 service lines per 1,000 service connections would be eligible for deferred deadlines longer than 10 years. • States are required to set a shorter deadline for a system where it determines that a shorter deadline is feasible. • Where property owner consent is required for a system to access the service line, systems must make a reasonable effort (at least 4 attempts) to engage property owners about full service line replacement. • Systems conducting partial service line replacement, if not prohibited by the rule, must offer to replace the remaining portion of the service line not under their control (within 45 days if replaced in coordination with an emergency repair).

Pre-2021 LCR	2021 LCRR	Final LCRI
	○ Offer to collect a lead tap sample at locations served by the replaced line within 3 to 6 months after replacement.* • Requires replacement of lead connectors when encountered.* • Systems must make 2 good faith efforts to engage customers about LSLR. • Systems conducting partial LSLR must offer to replace the remaining portion of the service line.	
LSL-Related Outreach • If a system replaces its portion only: ○ Provide notification to affected residences within 45 days prior to replacement on possible elevated short-term lead levels and measures to minimize exposure.* ○ Include offer to collect lead tap sample within 72 hours of replacement. ○ Provide test results within 3 business days after receiving results.	**LSL-Related Outreach** • Notify consumers annually if they are served by a lead, GRR, or unknown service line.* • Deliver notice and educational materials to consumers during water-related work that could disturb LSLs.* • Systems subject to goal-based program must: ○ Conduct targeted outreach that encourages consumers with LSLs to participate in the LSLR program. ○ Conduct an additional outreach activity if they fail to meet their goal. • Systems required to conduct LSLR must include information about the LSLR program in public education (PE) materials that are provided in response to P90 > action level.*	**Service Line-Related Outreach** • Deliver notice and educational materials during water-related work that could disturb lead, GRR, or unknown service lines, including disturbances due to inventorying efforts, to consumers within 24 hours or before service line is returned to service, and to customers within 30 days. • Provide filters to consumers for disturbances to a lead, GRR, or unknown service line caused by replacement of an inline water meter, water meter setter, connector, or water main. • If a CWS does not meet the mandatory service line replacement rate, the CWS must conduct additional public outreach activities to encourage customers with lead, GRR, and unknown service lines to participate in the service line replacement program. • Removes goal-based program outreach activities.
Action Level and Trigger Level		
• P90 level above lead action level of 0.015 mg/L or copper action level of 1.3 mg/L requires additional actions. • Lead action level exceedance requires 7 percent LSLR (includes partial replacements),	• P90 level above lead action level of 0.015 mg/L or copper action level of 1.3 mg/L requires more actions than the previous rule.	• Removes the lead trigger level. • P90 level above lead action level of 0.010 mg/L or copper action level of 1.3 mg/L requires actions including installation or re-

Pre-2021 LCR	2021 LCRR	Final LCRI
CCT recommendation and possible study and installation, and PE within 60 days after the end of the monitoring period.	• Defines lead trigger level as P90 > 0.010 mg/L and triggers additional planning, monitoring, and treatment requirements. • Lead action level exceedance requires 3 percent full LSLR, optimal corrosion control treatment (OCCT) installation or re-optimization, public education (PE), and public notification (PN) within 24 hours. • Trigger level exceedance requires goal-based LSLR and steps taken towards CCT installation or re-optimization.	optimization of CCT, PE, and 24-hour PN (for lead action level exceedances). • Mandatory full service line replacement of lead and GRR service lines is independent of P90 lead levels.
Lead and Copper Tap Monitoring		
Sample Site Selection • Prioritizes collection of samples from sites with sources of lead in contact with drinking water. • Highest priority given to sites served by copper pipes with lead solder installed after 1982 or containing lead pipes and sites served by LSLs. • Systems must collect 50 percent of samples from LSLs, if available.	**Sample Site Selection** • Prioritizes collecting samples from sites served by LSLs. All samples must be collected from sites served by LSLs, if available.* • Equal priority to copper pipes with lead solder, irrespective of installation date.* • Adds 2 tiers to prioritize sampling at lead and GRR service line sites above sites with copper with lead solder.*	**Sample Site Selection** • Combines the tap sample site selection tiering criteria for CWSs and NTNCWSs. • Removes galvanized service line or premise plumbing formerly downstream of a lead connector from Tier 3 sites. • Removes requirement for replacement sampling sites to be selected within reasonable proximity. • Clarifies that sites are considered no longer available for sampling after customer refusal or non-response after 2 outreach attempts.
Sample Collection and Inclusion in 90th Percentile Calculation • Requires collection of the first-liter sample after water has sat stagnant for a minimum of 6 hours.	**Sample Collection and Inclusion in 90th Percentile Calculation** • Requires collection of the fifth-liter sample in homes with LSLs after water has sat stagnant for a minimum of 6 hours. • Requires first-liter sample collection in homes without LSLs.* • Requires P90 lead calculation for systems with insufficient LSLs to meet the minimum number of samples required to include the highest samples from lower tiers for a total	**Sample Collection and Inclusion in 90th Percentile Calculation** • Requires collection of the first- and fifth-liter samples in structures with LSLs after water has sat stagnant for a minimum of 6 hours. • Requires systems with insufficient Tier 1 and 2 sites to meet the minimum number of samples required by calculating the P90 from the highest sample values from the highest tiers samples, equal to the minimum number required.

Pre-2021 LCR	2021 LCRR	Final LCRI
	number of samples equal to the minimum number required. • Prohibits inclusion of samples collected under find-and-fix in the P90 calculation.* • Adds requirement that samples must be collected in wide-mouth bottles.* • Prohibits sampling instructions that include recommendations for aerator cleaning/removal and pre-stagnation flushing prior to sample collection.*	• Requires the higher value of the first- and fifth-liter lead concentration in structures with LSLs to be used to calculate the P90 value for lead. • Prohibits inclusion of samples following service line replacement in the P90 calculation. Prohibits the inclusion of more than one sample per site in each P90 calculation. • Revises the definition of a wide-mouth bottle.
Monitoring Frequency • Samples are analyzed for both lead and copper. • Systems must collect standard number of samples based on population; semi-annually unless they qualify for reduced monitoring. • Systems can qualify for annual or triennial monitoring at reduced number of sites. Monitoring schedule based on the number of consecutive years meeting the following criteria: ○ Serves ≤ 50,000 persons and P90 is at or below the lead and copper action levels. ○ Serves any population size, meets State-specified optimized water quality parameters (OWQPs), and P90 ≤ lead action level. • Triennial monitoring also applies to any system with lead P90 ≤ 0.005 mg/L and copper P90 ≤ 0.65 mg/L for 2 consecutive 6-month monitoring periods. • Based on rule criteria, systems serving ≤ 3,300 persons can apply for a 9-year monitoring waiver.*	**Monitoring Frequency** • Samples are analyzed for lead and copper, only copper, or only lead. This occurs when lead monitoring is conducted more frequently or at more sites than copper, and at LSL sites where a fifth-liter sample is only analyzed for lead.* • Lead monitoring schedule is based on the P90 level for all systems as follows: ○ P90 > 0.015 mg/L: Semi-annually at the standard number of sites. ○ P90 > 0.010 mg/L but ≤ 0.015 mg/L: Annually at the standard number of sites. ○ P90 ≤ 0.010 mg/L: Annually at the standard number of sites and triennially at reduced number of sites using same criteria as the LCR except copper P90 level is not considered. • Initial standard monitoring required for systems with lead and GRR service lines, and any system that does not sample under the requirements of the LCRR by the compliance date. • Systems must resume standard monitoring if they exceed the action level, have a water	**Monitoring Frequency** • Monitoring schedule is based on both the P90 for lead and copper for all systems. Systems may retain or qualify for reduced monitoring based on the number of consecutive tap monitoring periods: ○ P90 ≤ action level for 2 consecutive 6-month periods: Annual monitoring at standard number of sites for lead and reduced number of sites for copper. ○ P90 < practical quantitation limit (PQL) for 2 consecutive 6-month periods: Triennial monitoring at the reduced number of sites for both lead and copper. • Initial standard monitoring schedule required for most systems with lead and/or GRR service lines in their inventory on the compliance. • Additional criterion for when systems must start standard monitoring: Systems with no lead or GRR service lines in their inventory on the compliance date must start standard monitoring if they identify a lead or GRR service line in the future.

Pre-2021 LCR	2021 LCRR	Final LCRI
	quality parameter (WQP) excursion, and other criteria.	
Corrosion Control Treatment and Water Quality Parameters		

CCT
• Systems serving > 50,000 persons were required to install treatment by January 1, 1997, with limited exception.
• Systems serving ≤ 50,000 that exceed lead and/or copper action level(s) are subject to CCT requirements (*e.g.*, CCT recommendation, study if required by the State, CCT installation). They can discontinue CCT steps if no longer exceed both action levels for 2 consecutive 6-month monitoring periods.
• Systems must operate CCT to meet any OWQPs designated by the State that define optimal CCT.
• There is no requirement for systems to re-optimize.
	CCT
	• Specifies CCT requirements for systems with P90 lead level > 0.010 mg/L but ≤ 0.015 mg/L:
	  ○ No CCT: Must conduct a CCT study if required by the State.
	  ○ With CCT: Must follow the steps for re-optimizing CCT, as specified in the rule.
	• Systems with P90 lead level > 0.015 mg/L:
	  ○ No CCT: Must complete CCT installation regardless of subsequent P90 levels if system has started to install CCT.
	  ○ With CCT: Must re-optimize CCT.
	• CWSs serving ≤ 10,000 persons and all NTNCWSs can select an option other than CCT to address lead. See the *Small System Flexibility* section of this exhibit.
		CCT
		• Systems with P90 lead level > 0.010 mg/L:
		  ○ No CCT: Must install CCT regardless of their subsequent P90 levels if they have started to install CCT.
		  ○ With CCT: Must re-optimize OCCT.
		  ○ Systems with OCCT meeting OWQPs need only re-optimize OCCT once, unless required to do so by the State.
		  ○ Systems with OCCT that exceed lead action level exceedance after complete removal of all lead and GRR service lines will need to re-optimize again.
		• CWSs serving ≤ 3,300 persons and all NTNCWSs can select an option other than CCT to address lead. See the *Small System Flexibility* section of this exhibit.
		• Deferred OCCT or re-optimized OCCT for systems that can complete removal of 100 percent of lead and GRR service lines within 5 years or less of the date they are triggered into CCT steps. Systems with CCT must maintain CCT during the 5-year-or-less service line replacement program.

CCT Options Includes alkalinity and pH adjustment, calcium hardness adjustment, and phosphate or silicate-based corrosion inhibitor.	**CCT Options** Removes calcium hardness as an option and specifies any phosphate inhibitor must be orthophosphate.*	**CCT Options** No changes from the LCRR.

Pre-2021 LCR	2021 LCRR	Final LCRI
WQPs • No CCT: pH, alkalinity, calcium, conductivity, temperature, orthophosphate (if phosphate-based inhibitor is used), silica (if silica-based inhibitor is used). • With CCT: pH, alkalinity, and based on type of CCT either orthophosphate, silica, or calcium.	**WQPs** • Eliminates WQPs related to calcium hardness (*i.e.*, calcium, conductivity, and temperature).* • All other parameters are the same as in the LCR.*	**WQPs** No changes from the LCRR.
WQP Monitoring • Systems serving > 50,000 persons must conduct regular WQP monitoring at entry points and within the distribution system. • Systems serving ≤ 50,000 persons conduct monitoring only in those periods that exceed the lead or copper action level. • Contains provisions to sample at reduced number of sites in distribution system less frequency for all systems meeting their OWQPs.	**WQP Monitoring** • Systems serving > 50,000 persons must conduct regular WQP monitoring at entry points and within the distribution system. • Systems serving ≤ 50,000 persons must continue WQP monitoring until they no longer exceed the lead and/or copper action level(s) for 2 consecutive 6-month monitoring periods. • To qualify for reduced WQP distribution monitoring, P90 lead level must be ≤ 0.010 mg/L and the system must meet its OWQPs.*	**WQP Monitoring** • Systems with CCT (unless deemed optimized) serving ≥ 10,000 persons must conduct regular WQP monitoring at entry points and within the distribution system. • Systems serving ≤10,000 persons and systems without CCT serving ≤ 50,000 persons that exceed the lead and/or copper action level(s) must conduct WQP monitoring until they no longer exceed lead and/or copper action level(s) for 2 consecutive 6-month monitoring periods. • Systems without CCT serving > 10,000 persons but ≤ 50,000 persons that exceed the lead action level that are required to install CCT, must continue to conduct WQP monitoring.
Sanitary Survey Review Treatment must be reviewed during sanitary surveys; no specific requirement to assess CCT or WQPs.	**Sanitary Survey Review** CCT and WQP data must be reviewed during sanitary surveys against most recent CCT guidance issued by the EPA.*	**Sanitary Survey Review** No changes from the LCRR.
Find-and-Fix No required follow-up samples or additional actions if an individual sample exceeds the lead action level.	**Find-and-Fix** If individual tap samples > 0.015 mg/L lead, find-and-fix steps include: • Conducting WQP monitoring at or near the site > 0.015 mg/L. • Collecting tap sample at the same tap sample site within 30 days.*	**Distribution System and Site Assessment** • Changes the name from "Find-and-Fix" to "Distribution System and Site Assessment" to describe this requirement more precisely. • Requirements from the LCRR affect systems with individual tap samples > 0.010 mg/L lead.

Pre-2021 LCR	2021 LCRR	Final LCRI
	○ For LSL, collect any liter or sample volume.* • Performing needed corrective action.* • Documenting customer refusal or non-response after 2 attempts.* • Providing information to local and State health officials.*	• Clarifies that the distribution system sample location must be within a half-mile radius of each site with a result > 0.010 mg/L. • Water systems without CCT are not required to collect WQP samples for the DSSA CCT assessment.
Small System Flexibility		
No provisions for systems to elect an alternative treatment approach but sets specific requirements for CCT and LSLR.	Allows CWSs serving ≤ 10,000 persons and all NTNCWSs to implement an alternate compliance option to address lead with State approval: • Systems with lead P90 > 0.010 mg/L recommend CCT, LSLR, provision and maintenance of point-of-use (POU) devices, or replacement of all lead-bearing plumbing materials. • If the system's P90 lead level > 0.015 mg/L, the system must implement the compliance option.	Allows CWSs serving ≤ 3,300 persons and all NTNCWSs with P90 levels > lead action level and ≤ copper action level to conduct the following actions in lieu of CCT requirements to address lead with State approval: • Choose a compliance option: (1) provision and maintenance of POU devices or (2) replacement of all lead-bearing plumbing materials. • Removes the compliance option to conduct LSLR in 15 years. Maintains option for systems following CCT requirements: • With CCT: Collect WQPs and evaluate compliance options and OCCT. • No CCT: Evaluate compliance options and CCT.
Public Education and Outreach		
• Systems with P90 > lead action level must provide PE to customers about lead sources, health effects, measures to reduce lead exposure, and additional information sources. • Systems with P90 > lead action level must offer lead tap sampling to customers who request it.	• Water systems must provide updated lead health effects language in PN and PE materials. CWSs must provide updated health effects language in the Consumer Confidence Reports (CCR). • For water systems serving a large proportion of consumers with limited English proficiency, PE materials must contain information in the appropriate language(s) regarding the	• Revises the mandatory lead health effects language to improve completeness and clarity. • Water systems must provide the updated health effects language in PN and all PE materials. CWSs must provide updated health effects language in the CCR. • For water systems serving a large proportion of consumers with limited English proficiency, all PE materials must contain information in

Pre-2021 LCR	2021 LCRR	Final LCRI

• Systems must provide lead consumer notice to individuals served at tested taps within 30 days of learning results.
• For water systems serving a large proportion of consumers with limited English proficiency, PE materials must contain information in the appropriate language(s) regarding the importance of the materials or information on where consumers can get a translated copy or assistance in other languages.
	importance of the materials or information on where consumers can get a translated copy or assistance in other languages.
	• If P90 > lead action level:
	  ○ LCRR PN and LCR PE requirements apply.
	  ○ Water systems must offer to sample the tap for lead for any customer who requests it.
	• Water systems must provide the lead consumer notice to consumers whose individual tap sample is > 0.015 mg/L lead as soon as practicable but no later than 3 calendar days.
	• CWSs must provide information to local and State health agencies.*
	Also see the *Public Notification, Consumer Confidence Report, and LSL-Related Outreach* sections of this exhibit.
		the appropriate language(s) regarding the importance of the materials and information on where consumers can get a translated copy or assistance in other languages, or the materials must be in the appropriate language(s).
		• Water systems must deliver consumer notice of lead and copper tap sampling results to consumers whenever their tap is sampled as soon as practicable but no later than 3 business days after receiving the results, regardless of the level.
		• If P90 > lead action level:
		  ○ LCRR PN requirements apply.
		  ○ Water systems must conduct PE no later than 60 days after the end of the tap sampling period until the system no longer exceeds the action level unless the State approves an extension.
		  ○ Water systems must deliver PE materials to bill paying customers and every service connection address served.
		• Water systems with multiple lead action level exceedances (at least 3 action level exceedances in a 5-year period) must conduct additional public outreach activities and make filters available. Water systems must submit a filter distribution plan to the State within 60 days of the second action level exceedance, and the State will have 60 days to review. The State has discretion to allow the system to discontinue outreach activities and filter provision earlier if it completes actions to reduce lead levels.
		• Water systems must offer to sample the tap for lead for any consumer with a lead, GRR, or unknown service line who requests it.

<table>
<tr><th>Pre-2021 LCR</th><th>2021 LCRR</th><th>Final LCRI</th></tr>
<tr><td></td><td></td><td>Also see the Public Notification, Consumer Confidence Report, and Service Line Related Outreach sections of this exhibit.</td></tr>
<tr><td colspan="3">Public Notification</td></tr>
<tr><td>• If P90 > action level:
  ○ No PN required for P90 > action level.
• Tier 2 PN required for violations to § 141.80 through § 141.85.
• Tier 3 PN required for violations to § 141.86 through § 141.89.
Also see the Public Education and Outreach section of this exhibit.</td><td>• If P90 > lead action level:
  ○ Systems must notify consumers of P90 > action level within 24 hours (Tier 1 PN). Systems must comply by October 16, 2024.
• Tier 2 PN required for violations to § 141.80 (except § 141.80(c)) through § 141.84, § 141.85(a) through (c) and (h), and § 141.93.
• Tier 3 PN required for violations to § 141.86 through § 141.90.
Also see the Public Education and Outreach section of this exhibit.</td><td>• If P90 > lead action level of 0.010 mg/L:
  ○ LCRR Tier 1 PN requirements apply, but for the proposed LCRI action level of 0.010 mg/L.
• Tier 2 PN required for violations to § 141.80 (except § 141.80(c)) through § 141.84, § 141.85(a) through (c) (except § 141.85(c)(3)) and (h) and (j), and § 141.93.
• Tier 3 PN required for violations to § 141.86 through § 141.90 and § 141.92.
• Water systems must provide updated lead health effects language in PN.
Also see the Public Education and Outreach section of this exhibit.</td></tr>
<tr><td colspan="3">Consumer Confidence Report</td></tr>
<tr><td>• All CWSs must provide educational material in the annual CCR.</td><td>• CWSs must provide updated health effects language in the CCR.
• All CWSs are required to include information on how to access the LSL inventory and how to access the results of all tap sampling in the CCR.
• Revises the mandatory health effects language to improve accuracy and clarity.</td><td>• Revises the mandatory lead health effects language and informational statement as well as includes additional information about risk of lead exposure in the informational statement about lead in the CCR to improve completeness and clarity.
• CWSs must provide updated health effects language in the CCR.
• CWSs must include a statement in the CCR about the system sampling for lead in schools and child care facilities and direct the public to contact their school or child care facility for further information.
• CWSs with lead, GRR, or unknown service lines must include a statement in the CCR about</td></tr>
</table>

Pre-2021 LCR	2021 LCRR	Final LCRI
		how to access the service line inventory and replacement plan. Also see the *Public Education and Outreach* section of this exhibit.
	Change in Source of Treatment	
Systems on a **reduced** tap monitoring schedule must obtain prior State approval before changing their source or treatment.	Systems on **any** tap monitoring schedule must obtain prior State approval before changing their source or treatment. These systems must also resume a standard lead and copper tap monitoring schedule.*	No changes from the LCRR.
	Source Water Monitoring and Treatment	
Periodic source water monitoring for lead and copper is required for systems with: • Source water treatment; or • P90 > action level and no source water treatment.	States can waive continued source water monitoring for lead and copper if the:* • System has already conducted source water monitoring for a previous P90 > action level; • State has determined that source water treatment is not required; and • System has not added any new water sources.	Updated cross-reference to requirement for conducting standard monitoring when there is a source water addition.
	Lead in Drinking Water at Schools and Child Care Facilities	
• Does not include separate testing and education program for CWSs at schools and child care facilities. • Schools and child care facilities that are classified as NTNCWSs must sample for lead and copper.*	• CWSs must provide annual public education materials to all schools and licensed child care facilities they serve. • CWSs must conduct sampling at 20 percent of elementary schools and 20 percent of licensed child care facilities they serve per year and conduct sampling at secondary schools on request for first testing cycle (5 years) and conduct sampling on request of all schools and child care facilities thereafter. • Sample results must be provided to each sampled school/child care facility, State, and local or State health department.	Expands on LCRR requirements to include: • Waivers for CWSs to sample in schools and child care facilities during the first 5-year testing cycle if the facility has been sampled between January 1, 2021, and the LCRI compliance date. • Requires CWSs to include a statement about the opportunity for schools and child care facilities to be sampled in the CCR. • Excludes schools and licensed child care facilities constructed or had full plumbing replacement on or after January 1, 2014 and

Pre-2021 LCR	2021 LCRR	Final LCRI
	• Excludes schools and licensed child care facilities constructed on or after January 1, 2014. • Waives schools and child care facilities that were sampled under a State or other program after October 16, 2024.	that are also not served by a lead, GRR, or unknown service line. • Includes clarifications on the applicability of the requirements and on the content of public education material CWSs must provide to schools and licensed child care facilities.
Primacy Agency (or State) Reporting		
States must report information to the EPA that includes, but is not limited to: • All P90 lead levels for systems serving > 3,300 persons, and only levels > 0.015 mg/L for smaller systems. • Only copper P90 levels above the copper action level for all systems. • Systems that are required to initiate LSLR and the date replacement must begin. • Systems for which OCCT has been designated. States must keep records on information that includes, but is not limited to: • Records of the currently applicable or most recent State determinations, including all supporting information and an explanation of the technical basis for each decision State primacy requirements include, but are not limited to: • Designating OCCT • Designating source water treatment methods • Verifying service line replacement schedules	States must report information to the EPA that includes, but is not limited to: • All lead and copper P90 levels for all system sizes.* • The number of lead, GRR, and unknown service lines for every water system.* • The goal-based or mandatory replacement rate and the date each system must begin LSLR. • OCCT status of all systems including OWQPs specified by the State.* • For systems triggered into source water treatment, the State-designated date or determination for no treatment required.* States must keep records on information that includes, but is not limited to: • LSLR plans.* • Compliance sampling pools.* • Determinations related to source water treatment.* • Determinations related to compliance alternatives for small CWSs and NTNCWSs.* • LSL inventories.* State primacy requirements include, but are not limited to: • Reviewing service line inventory.* • Approving LSLR goals.	States must report information to the EPA that includes, but is not limited to: • The current numbers of lead, GRR, unknown, and non-lead service lines, lead connectors, and unknown connectors in each system's inventory. • The numbers and types of service lines replaced and the replacement rate for every system conducting mandatory service line replacement. • The deadline for the system to complete replacement of all lead and GRR service lines. • The expected date of completion of service line replacement. • The lead P90 levels of systems with an action level exceedance within 15 days of the end of the monitoring period or, if earlier, within 24 hours of receiving the notice from the system. • The result of the State's determination as to whether the deferred deadline is the fastest feasible, the deadline at the fastest feasible rate, and the reasons for the State's decision. States must keep records on information that includes, but is not limited to: • Samples that do not meet the six-hour minimum stagnation time. • Determinations concerning systems eligible for deferred deadlines for service line

Pre-2021 LCR	2021 LCRR	Final LCRI
	• Determining if a greater LSLR rate is feasible.* • Defining school and child care program and determining if State or local testing program is at least as stringent as Federal requirements. • Verifying compliance with “Find-and-Fix” requirements.* • Reviewing any change in source water treatment.*	replacement. Adds State primacy requirements to: • Identify State laws that pertain to a water system’s access to conduct full service line replacement. • Make determinations about systems eligible for service line replacement deferred deadlines. • Make determinations about which water systems serve a large proportion with limited English proficiency and provide technical assistance to those systems required to meet the requirements to provide translated PE or translation assistance to their consumers. • Review and approve inventory validations.

1.2 Document Organization

The remainder of this EA is organized into the following chapters:

- **Chapter 2: Need for the Rule** summarizes the goal of the final LCRI, why the EPA revised the prior lead and copper regulations, and the regulatory history. It also explains the statutory authority for the final LCRI and the economic rationale for the regulatory approach.
- **Chapter 3: Baseline Drinking Water System** describes the systems subject to the final LCRI, including the populations they serve and CCT status, lead and copper tap water concentration levels, the characterization of service line material in the United States, the proportion of systems on reduced monitoring, and the rate of historical source water and treatment changes to characterize the baseline before the EPA models estimated changes that result from complying with the final LCRI requirements.
- **Chapter 4: Economic Impact and Cost Analysis of the Final Lead and Copper Rule Improvements** describe how the final LCRI regulatory requirements are implemented, and the unit cost of actions taken by PWSs and the State to comply with the requirements. The chapter also provides estimates of the total costs of the 2021 LCRR and the final LCRI, as well as the estimated incremental costs of the final LCRI.
- **Chapter 5: Benefits Resulting from the Lead and Copper Rule** provides a description of the estimated health benefits for the final regulatory changes affecting systems and States and provides estimates of total benefits for the 2021 LCRR and the final LCRI, as well as the estimated incremental benefits for the final LCRI requirements.
- **Chapter 6: Comparison of Costs to Benefits** provides a summary of costs and benefits associated with the provisions of the 2021 LCRR and the final LCRI requirements. The chapter also describes the incremental costs and benefits of the final LCRI.
- **Chapter 7: Statutory and Administrative Requirements** discusses distributional analyses performed to evaluate the effects of the final LCRI options on different segments of the population in accordance with 13 federal mandates and statutory reviews, including but not limited to the Regulatory Flexibility Act, Unfunded Mandates Reform Act, and Executive Order 12898 on, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.
- **Chapter 8: Other Options Considered** presents other alternatives the EPA evaluated when developing the final LCRI. These include alternative lead ALs and LSLR rates.

1.3 Calculations and Citations

This EA involves numerous detailed and complex analyses, and the following are provided to help the reader understand how those analyses were conducted and their underlying data and assumptions:

- Appendices containing supporting spreadsheets and analyses:
  - Appendix A: LSLR Unit Costs

- Appendix B: Modeling Costs in the SafeWater LCR Model for the Final LCRI, 2021 LCRR, and the Pre-2021 LCR
- Appendix C: Incremental Costs of the Final LCRI from the Pre-2021 LCR
- Appendix D: Adverse Health Effects Associated with Lead Exposures
- Appendix E: Adverse Health Effects Associated with Copper Exposures
- Appendix F: Sensitivity Analysis for IQ Valuation in Children and Costs and Benefits of the Final Rule at a 3 Percent and 7 Percent Discount Rate

- Tabular exhibits, most of which include a row with the formulas used to calculate the contents of each column and information sources for values that are not calculated in the exhibits.
- Exhibits that illustrate methodologies of analyses as well as final LCRI requirements.
- Supporting report and electronic spreadsheet files, as explained in Exhibit 1-2 below.

Exhibit 1-2: Supporting Report and Spreadsheet Files

File Name	Description
Administrative Burden and Costs_Final.xlsx	Provides one-time and ongoing administrative burden and costs associated with the pre-2021 LCR, 2021 LCRR, and final LCRI for water systems and States.
Analysis of School_Child Care Sample Number_Final.xlsx	Provides an estimate of the number of taps from which a school or child care facility would collect lead samples, based on the 3Ts guidance. Used to estimate the number of schools and child care facilities that can be tested using WIIN grant funding. Serves as a supporting file for "School_Child Care Inputs_Final.xlsx."
ASDWA CoSTS_2024_Revised	Provides ASDWA's estimated increase burden estimates for States to oversee the requirements of the LCRI. The EPA used these estimates and those provided in the file, "Final CoSTS 2-6-20.xlsx" to develop costs for the final LCRI.
CCT Study and Review Costs_Final.xlsx	Provides the EPA's assumptions regarding which systems will be required to conduct a CCT study and if applicable, if the study will be a desktop or demonstration study, and the estimated costs of these studies under the pre-2021 LCR. Also, provides State CCT review-related activities for the pre-2021 LCR, 2021 LCRR, and the final LCRI.
Customer Requested Sample Percent_Final.xlsx	Provides the percentage of samples requested based on information provided on five system's websites. Used as a supporting file for "Lead Analytical Burden and Costs_Final.xlsx."
CWS Inventory Characteristics_Final.xlsx	Provides inventory, milestone, violation, and treatment information from the SDWIS/Fed 4th quarter 2020 "frozen" dataset for 49,529 CWSs and how these data are used to provide baseline system characteristics described in Chapter 3 and Appendix B.
DWINSA_StateDate_LSL_Status_Final.xlsx	Provides system-specific information for the subset of CWSs with

File Name	Description
	known LSL status (either presence or absence of LSLs or unknowns) based on data from (1) the 7th DWINSA and its one-time update of service line materials; (2) service line inventory information for 13 States and Region 9 tribal systems; and (3) additional web searches of systems with prior or ongoing LSLR programs; (4) and discussions with systems serving more than 1 million people. This file also includes the geographic representativeness of States with known LSL status.
Estimated Driving Distances_Final.xlsx	Outlines the EPA's approach for estimating the distance a water system would drive to a customer's home for lead sampling, site investigation, or other reasons.
Extent of P90 Data_LCR_Final.xlsx	Provides the estimated percentage of CWSs with at least one reported P90 value during 2012 – 2020 and the percentage with known LSL status (the presence or absence of LSLs) for three system size categories to determine if systems serving ≤ 3,300 people were underrepresented.
Failure to Meet LSLR Goals_Final.xlsx	Calculates the burden and costs for CWSs serving > 10,000 people with a TLE to conduct outreach activities if they fail to meet their annual LSLR goal under the 2021 LCRR.
Final CoSTS 2-6-20.xlsx	Provides ASDWA's estimated increase burden estimates for States to oversee the requirements of the final 2021 LCRR. The EPA used these estimates and those provided in ASDWA CoSTS_2024_Revised.xlsx" to develop costs for the 2021 LCRR and final LCRI.
General Cost Model Inputs_Final.xlsx	Provides general costing inputs that include system and State labor costs, postage, paper, ink, and envelopes.
Initial P90 Categorization_LCR_Final.xlsx	Assigns CWSs to one of five P90 categories using two approaches under the pre-2021 LCR: A low estimate based on their average P90 level and high estimate based on their highest P90 level. These estimates represent the baseline condition before systems implement the requirements of the final LCRI.
Initial P90 Categorization_LCRI_Final.xlsx	Assigns CWSs to one of five P90 categories using two approaches under the final LCRI: A low estimate based on their average P90 level and high estimate based on their highest P90 level. Also includes adjusted lead 90th percentile results from systems with LSLs using two multipliers to reflect new sampling requirements under the final LCRI, including an adjustment to simulate the expected increase on the P90 if a system with LSLs uses the higher of the paired first- and fifth-liter sample.
Initial P90 Categorization_LCRR_Final.xlsx	Assigns CWSs to one of five P90 categories using two approaches under the 2021 LCRR: A low estimate based on their average P90 level and high estimate based on their highest P90 level. Also includes adjusted lead 90th percentile results from systems with LSLs using two multipliers to reflect new sampling requirements under the 2021 LCRR.
Initial P90 Categorization_CWS_NTNCWS_LCR	Compares the distribution of NTNCWSs across the five lead 90th percentile categories as a function of CCT and LSL status to that

File Name	Description
Compare_Final.xlsx	developed for CWSs.
Inventory Updates and Validation_Final.xlsx	Provides the burden and costs for updating the service line inventory under the 2021 LCRR and final LCRI and performing validation for a subset of service lines categorized as non-lead under the final LCRI.
LCRI Updated Initial Inventory with Connectors_Final.xlsx	Provides the burden and costs to update the initial service line inventory with connector material information.
Lead Analytical Burden and Costs _Final.xlsx	Provides estimated burden and costs for lead sample collection, analysis, and reporting as well as assumptions and data sources for each estimate.
Lead_WQP_Sample Bottle Costs_Final.xlsx	Provides 250 mL, 500 mL, and 1 liter bottle costs. Used as a supporting file for estimating lead and WQP analytical burden and costs and school and child care facility testing.
Likelihood_Sample_Above_AL_LCRI_DSSA _Final.xlsx	Provides estimates of the likelihood of an individual tap sample being above the lead AL based on system size, LSL status, and P90 classification under the final LCRI. Also provides estimated burden and costs associated with the DSSA[1].
Likelihood_Sample_Above_AL_LCRR_Find _Fix_Final.xlsx	Provides estimates of the likelihood of an individual tap sample being above the lead AL based on system size, LSL status, and P90 classification under the 2021 LCRR. Also provides estimated burden and costs associated with find-and-fix.
Likelihood_SourceChange_Final.xlsx	Provides the estimated likelihood that a CWS or NTNCWS will add a new source or change its primary source. Also includes reporting, review, and State consultation associated with this change.
Likelihood_TreatmentChange_Final.xlsx	Provides the estimated likelihood that a CWS or NTNCWS will add a new treatment. Also includes reporting, review, and State consultation associated with this change.
LSLR Ancillary Costs_Final.xlsx	Provides the derivation of costs associated with SLR activities other than physical replacement.
LSLR Unit Cost.xlsx	Provides the derivation of the SL physical replacement costs based on the 7th DWINSA.
LSLR_Time_Span_Analysis_CWS_Final.xlsx	Estimates the average length of time a CWS that is triggered into LSLR replaces LSLs under the pre-2021 LCR. The results of this analysis are also used for NTNCWSs under the pre-2021 LCR.
MI_LCR_Sample_Database	This workbook contains the Michigan lead tap sampling data from 2019, 2020, and 2021. The data are used in several analyses presented in this EA.
Multiple Lead ALE_LCRI_5_AL_Final.xlsx	Provides the percentage of systems with at least 2 lead ALEs in 5 years that had at least 3 lead ALEs based on a lead AL of 5 µg/L as opposed to the final LCRI AL of 10 µg/L. This information is used to develop costs for other options the EPA considered, as presented in Chapter 8 of this EA.
Multiple Lead ALEs_LCRI_10_AL_Final.xlsx	Provides the percentage of systems with at least 2 lead ALEs in 5 years that had at least 3 lead ALEs under the final LCRI lead AL of 10 µg/L.
Multiple Lead ALE_LCRI_15_AL_Final.xlsx	Provides the percentage of systems with at least 2 lead ALEs in 5

File Name	Description
	years that had at least 3 lead ALEs based on a lead AL of 15 µg/L as opposed to the final LCRI AL of 10 µg/L. This information is used to develop costs for other options the EPA considered, as presented in Chapter 8 of this EA.
NTNCWS Inventory Characteristics_Final.xlsx	Provides inventory, milestone, violation, and treatment information from the SDWIS/Fed 4th quarter 2020 "frozen" dataset for 17,418 NTNCWSs and how these data are used to provide baseline system characteristics described in Chapter 3 and Appendix B.
P90_Unknown LSL vs. LSL Known Status CWSs_Final xlsx	Compares the P90 data for the subset of systems with known LSLs status and reported P90 values to the larger set of CWSs with at least one reported P90 value (but unknown LSL status) in SDWIS/Fed for 2012 – 2020 to determine the representativeness of the subset.
Pb Schedules_CWS_Final.xlsx	Estimates baseline lead tap sampling schedules for CWSs using the SDWIS/Fed 4th quarter 2020 "frozen" dataset starting in Year 4 of the 35-year analysis period. These schedules are also used for CWSs without LSLs starting in Year 5 for those with P90 ≤ 15 µg/L and P90 ≤ 10 µg/L, under the 2021 LCRR and final LCRI, respectively.
Pb Schedules_NTNCWSs_Final.xlsx	Estimates baseline lead tap sampling schedules for NTNCWSs using the SDWIS/Fed 4th quarter 2020 "frozen" dataset starting in Year 4 of the 35-year analysis period. These schedules are also used for NTNCWSs without LSLs starting in Year 5 for those with P90 ≤ 15 µg/L and P90 ≤ 10 µg/L, under the 2021 LCRR and final LCRI, respectively.
POU Inputs_Final.xlsx	Provides costing inputs for small CWSs and those NTNCWSs that select POU devices as their compliance option. Includes the estimated number of required POU devices, development of a POU process, annual reporting, and State review.
Public Education Inputs_CWS_Final.xlsx	Provides the derivation of the inputs used to estimate PE burden and costs under the pre-2021 LCR, 2021 LCRR, and final LCRI for CWSs.
Public Education Inputs_NTNCWS_Final.xlsx	Provides the derivation of the inputs used to estimate PE burden and costs under the pre-2021 LCR, 2021 LCRR, and final LCRI for NTNCWSs.
Robocall Pricing Estimates_Final.xlsx	Provides the quotes from three companies for robocalling services. The average of costs from these companies is used to estimate costs for some outreach activities for CWSs.
Sample Kits and Shipping Costs_Final.xlsx	Provides the cost of a sample kit that includes the container, paper for instructions and chain-of-custody, plastic bag to prevent the paper for getting wet, and labels. Bottle costs are included in the file "Lead_WQP_Sample Bottle Costs," "Lead Analytical Burden and Costs_Final.xlsx," and "WQP Analytical Burden and Costs_Final.xlsx."
School_Child Care Inputs_Final.xlsx	Provides the derivation of the inputs used to estimate the burden and costs for CWSs to conduct a lead in drinking water testing

File Name	Description
	program at schools and licensed child care facilities.
Service Line Characterization Using DWINSA_Final.xlsx	Provides the derivation of the estimated percent of systems with service lines of different material, and the percent of service lines of different materials in those systems. For the pre-2021 LCR only, also provides the percent of systems that test their LSLs before replacing them to determine if any meet the tested-out criteria and would not need to be replaced, and an estimated percent of those service lines that meet the tested-out criteria.
Summary of Lab Responses_7 labs_Final.xlsx	Provides commercial lab costs for lead, orthophosphate, alkalinity, and calcium. These estimates are used for lead and WQP analytical cost files, school and child care facility testing, and “CCT Study and Review_Final.xlsx.”
Two Lead ALEs_LCRI_5_AL_Final.xlsx	Provides the percentage of systems with at least 2 lead ALEs in 5 years based on a lead AL of 5 µg/L as opposed to the final LCRI action level of 10 µg/L. This information is used to develop costs for other options the EPA considered, as presented in Chapter 8 of this EA.
Two Lead ALEs_LCRI_10_AL_Final.xlsx	Provides the percentage of systems with at least 2 lead ALEs in 5 years under the final LCRI.
Two Lead ALEs_LCRI_15_AL_Final.xlsx	Provides the percentage of systems with at least 2 lead ALEs in 5 years based on a lead action level of 15 µg/L as opposed to the final LCRI action level of 10 µg/L. This information is used to develop costs for other options the EPA considered, as presented in Chapter 8 of this EA.
VLSEntryPointValues_Final.xlsx	Provides a summary of entry point-level data compiled by the EPA for LSL and CCT estimates for systems serving more than 1 million people.
VLSSystemData.xlsx	Provides a summary of system-level data compiled by the EPA for LSL and CCT estimates for systems serving more than 1 million people.
WQP Analytical Burden and Costs_Final.xlsx	Provides the derivation of the inputs used to estimate burden and costs for system WQP sample collection, analysis, and reporting and State review.
WQP Schedules_CWS_LCR_Final.xlsx	Estimates the initial WQP distribution system monitoring schedules under the pre-2021 LCR for CWSs using the SDWIS/Fed 4th quarter 2020 "frozen” dataset.
WQP Schedules_CWS_LCRI_Final.xlsx	Estimates the initial WQP distribution system monitoring schedules under the final LCRI for CWSs using the SDWIS/Fed 4th quarter 2020 "frozen” dataset.
WQP Schedules_CWS_LCRR_Final.xlsx	Estimates the initial WQP distribution system monitoring schedules under the 2021 LCRR for CWSs using the SDWIS/Fed 4th quarter 2020 "frozen” dataset.
WQP Schedules_NTNCWS_LCR_Final.xlsx	Estimates the initial WQP distribution system monitoring schedules under the pre-2021 LCR for NTNCWSs using the SDWIS/Fed 4th quarter 2020 "frozen” dataset.
WQP Schedules_NTNCWS_LCRI_Final.xlsx	Estimates the initial WQP distribution system monitoring

File Name	Description
	schedules for NTNCWSs under the final LCRI using the SDWIS/Fed 4th quarter 2020 "frozen" dataset.
WQP Schedules_NTNCWS_LCRR_Final.xlsx	Estimates the initial WQP distribution system monitoring schedules for NTNCWSs under the 2021 LCRR using the SDWIS/Fed 4th quarter 2020 "frozen" dataset.

Acronyms: AL = action level; ALE = action level exceedance; ASDWA = Association of State Drinking Water Administrators; CCT = corrosion control treatment; CoSTS = Costs of State Transactions Study; CWS = community water system; DSSA = Distribution System and Site Assessment; DWINSA = Drinking Water Infrastructure and Needs Assessment; EA = economic analysis; LCR = Lead and Copper Rule; LCRR = Lead and Copper Rule revisions; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; POU = point-of use; SDWIS/Fed: Safe Drinking Water Information System/Federal Version; SL = service line; SLR = service line replacement; TLE = trigger level exceedance; VLS = very large system; WQP = water quality parameter.

Notes:

General: These documents are available in the docket for the final rule under docket number EPA-HQ-OW-2022-0801 at https://www.regulations.gov.

[1] In the final LCRI, the EPA replaced the term "find-and-fix" with "Distribution System and Site Assessment."

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2 Need for the Rule

Lead and copper enter drinking water primarily through the corrosion of distribution system and household plumbing materials that contain these metals. The goal of the Lead and Copper Rule (LCR) is to protect public health by reducing exposure to lead and copper in drinking water and the associated health risks from this exposure. The LCR accomplishes this primarily by controlling water corrosivity, thereby minimizing the leaching of these metals from household plumbing and drinking water distribution system components.

The Lead and Copper Rule Revisions (LCRR) was published in the *Federal Register* on January 15, 2021. As previously discussed in Chapter 1, the Environmental Protection Agency (EPA) published the agency's decision to delay the effective and compliance dates of the 2021 LCRR (86 FR 71574; USEPA, 2021a) on June 16, 2021, to allow time for the EPA to review the rule in accordance with Presidential directives issued on January 20, 2021 (Executive Order 13990), that directed Federal agencies to review certain regulations and conduct important consultations with affected parties. The agency reviewed the 2021 LCRR to further evaluate if the rule protects families and communities, particularly those that have been disproportionately impacted by lead in drinking water. The agency concluded that there are significant opportunities to improve the 2021 LCRR. The EPA identified priority improvements for the Lead and Copper Rule Improvements (LCRI): proactive and equitable lead service line replacement (LSLR), strengthening compliance tap sampling to better identify communities most at risk of lead in drinking water and to compel lead reduction actions, and reducing the complexity of the regulation through improvement of the action and trigger level construct. Based on this review (also referred to as the LCRR Review), the EPA decided to proceed with the development of the proposed LCRI that would revise certain key sections of the 2021 LCRR while allowing the rule to take effect, and highlighted other nonregulatory actions that the EPA and other Federal agencies could take to reduce exposure to lead in drinking water. The purpose of this economic analysis (EA) is to provide additional technical information on the final LCRI.[5]

A number of activities and sources of information and input have contributed to the development of the final LCRI, including but not limited to LCR stakeholder meetings held by the EPA; input from the Science Advisory Board (SAB); recommendations made by the National Drinking Water Advisory Council (NDWAC) and its Lead and Copper Rule Working Group (LCRWG); comments received in response to consultations with State, local, and tribal governments and intergovernmental organizations in 2018 and in prior years; and comments received from the public in response to the November 13, 2019 proposed LCRR. More currently, these include engagements conducted as part of the EPA's LCRR Review and development of the proposed LCRI, consultations and engagements conducted with key stakeholders on aspects of the 2021 LCRR, the EPA is considering for revision under the LCRI. These activities and sources of input are described further in Section 2.2 and collectively contributed to the development of the final LCRI as summarized in Chapter 1.

[5] The EPA is required to adhere to the Administrative Procedure Act during the process of developing and issuing regulations: https://www.archives.gov/federal-register/laws/administrative-procedure.

The remainder of this chapter is organized as follows:

- **Section 2.1** provides the statutory requirements, a chronology of the regulatory actions, and initiatives affecting lead and copper in drinking water prior to the publication of the final LCRI.
- **Section 2.2** provides a description of the activities following the LCR Short-Term Revisions that have informed development of the revised LCRI.
- **Section 2.3** includes a description of the EPA's mandated review of the 2021 LCRR and subsequent consultations that the EPA considered in the development of the final LCRI.
- **Section 2.5** discusses regulatory authority for the regulation.
- **Section 2.6** discusses the economic rationale for the regulation.

2.1 Statutory Requirements, Regulatory Actions and National EPA Initiatives Affecting Lead and Copper in Drinking Water

This section provides a chronology of regulatory actions and initiatives affecting lead and copper in drinking water prior to the publication of the final LCRI.

2.1.1 Safe Drinking Water Act (SDWA) Requirements and Drinking Water Regulations Addressing Lead Prior to 1991

SDWA (Public Law 93-523), passed in 1974, authorized the EPA to establish National Primary Drinking Water Regulations (NPDWRs) for public water systems (PWSs). The EPA published national interim primary drinking water regulations on December 24, 1975. Included among those regulations was a maximum contaminant level (MCL) of 0.05 mg/L (or 50 µg/L) for lead. The monitoring requirements for lead under these interim regulations focused on limiting the lead levels of drinking water entering the distribution system. The supporting materials for these interim regulations (USEPA, 1976) recognized to some degree that elevated lead levels were due to corrosion problems in the distribution system and household plumbing; however, the regulation did not address this source of contamination.

Amendments to SDWA in 1986 (Public Law 99-339) required the use of "lead free" materials in the installation or repair of pipes, fixtures, solders, and fluxes in any facility that provides water for human consumption. As defined in SDWA Section 1417(d), "lead free" solders and fluxes may not contain more than 0.2 percent lead, and "lead free" pipes, pipe fittings, and well pumps could not at the time contain more than 8.0 percent lead. All States were required to implement the "lead ban" by August 6, 1988 (52 FR 20674; USEPA, 1987).

To limit children's exposure to lead, one of the most sensitive populations, Congress passed the Lead Contamination Control Act (LCCA) (Public Law 100-572) in 1988 that further amended the SDWA. The LCCA is aimed at the identification and reduction of lead in drinking water at schools and child care centers, including the recall of drinking water coolers with lead lined tanks and the publication of a list of drinking water coolers that were not "lead free." It required the EPA to provide guidance to States and localities to test for and remedy lead contamination in drinking water at schools and child care

centers.[6] In addition, the LCCA required testing, recall, repair, and/or replacement of water coolers with lead-lined storage tanks or with other parts containing lead. One section of the LCCA that required States to establish program to conduct testing and remedial actions has since been repealed as part of the Water Infrastructure Improvements for the Nation Act (WIIN Act) (Public Law 114-322, Dec. 16, 2016; United States, 2016). Prior to the WIIN Act repeal of that section of the LCCA, in 1996, the U.S. Court of Appeals for the 5th Circuit held that this now-repealed provision requiring States to establish programs for testing and remediating lead was unconstitutional under the Tenth Amendment because it directly compelled States to enact and enforce a federal regulatory program and provided no options for the States to decline.[7] Since that time, the EPA developed and revised its voluntary program for States, schools, and child care facilities to address lead in drinking water (USEPA, 2018). In 2016, the WIIN Act replaced the repealed version of Section 1464(d) of the SDWA with a new provision establishing a voluntary school and child care lead testing grant program. 42 US.C. § 300j-24(d). Many States have also enacted their own testing programs.[8]

2.1.2 Lead and Copper Rule (1991)

The 1986 SDWA amendments directed the EPA to revise the regulations for lead and copper in drinking water. In response to this directive, the agency proposed revisions in 1988. On June 7, 1991, the EPA promulgated the LCR (56 FR 26460; USEPA, 1991), and established a maximum contaminant level goal (MCLG) of 0 for lead and 1.3 mg/L for copper. The LCR established treatment technique requirements instead of an MCL. Section 1412(b)(7)(A) of SDWA authorizes the EPA to “promulgate a national primary drinking water regulation that requires the use of a treatment technique in lieu of establishing an MCL, if the Administrator makes a finding that it is not economically or technologically feasible to ascertain the level of the contaminant.” The EPA’s decision to promulgate a treatment technique rule for lead instead of an MCL in 1991 has been upheld by the United States Court of Appeals for the District of Columbia Circuit. American Water Works Association (AWWA) v. EPA, 40 F.3d 1266, 1270-71 (D.C Cir. 1994).

In establishing treatment technique requirements, the Administrator is required to identify those treatment techniques “which in the Administrator’s judgment, would prevent known or anticipated adverse effects on the health of persons to the extent feasible.” 42 U.S.C. § 300g-1(b)(7)(A). “Feasible” is defined in Section 1412(b)(4)(D) of SDWA as “feasible with the use of the best technology, treatment techniques and other means which the Administrator finds after examination for efficacy under field

[6] In response to the LCCA, the EPA developed the guidance document, “Lead in Drinking Water in Schools and Non-residential Buildings in April 1994.” Some states have initiated their own testing efforts, which may be dictated by state-specific regulations. See Chapter 3, Section 3.3.10.2 for more information on States with lead testing programs in schools and child care facilities.

[7] No. 94-30714 (81 F.3d 1387) (5th Cir. April 22, 1996). For more information about this case, see: https://caselaw.findlaw.com/us-5th-circuit/1340297.html.

[8] The EPA assessed existing State-level requirements for lead in drinking water testing in schools and child care facilities. Currently 17 States have mandatory testing requirements for schools of which 16 have comparable programs to the proposed rule. Eleven States have mandatory requirements for testing at child care facilities of which nine have requirements that are comparable to the final LCRI mandatory testing criteria. All States have received WIIN grant funding to conduct testing. See Chapter 3, Section 3.3.10.2 for additional detail on the EPA’s assessment of current State school and child care facility testing requirements, how they compare with the final LCRI requirements, and the assumed application of WIIN grant funding for testing.

conditions and not solely under laboratory conditions, are available (taking cost into consideration)." The 1991 LCR established requirements for PWSs to conduct tap sampling at households with plumbing materials containing lead and copper. The 1991 LCR set an action level (AL) of 0.015 mg/L (or 15 µg/L) for lead and 1.3 mg/L (or 1,300 µg/L) for copper. The AL is exceeded if the concentration in more than 10 percent of water samples (*i.e.*, the 90th percentile level) collected at interior taps during any monitoring period is greater than 0.015 mg/L for lead or 1.3 mg/L for copper. Water systems that exceed the AL are not in violation of the LCR, but these systems are required to take actions to reduce drinking water lead and copper exposure including corrosion control treatment (CCT),[9] public education (PE), and LSLR.

2.1.3 SDWA Amendments (1996)

The 1996 Amendments to SDWA added that "lead free" plumbing fittings and fixtures must meet standards established under Section 1417(e) (42 U.S.C. 300g–6(e)). Section 1417(e) of SDWA required the EPA to accept a voluntary standard within a year or issue a regulation within two years. Furthermore, for the voluntary standard to be accepted, the EPA Administrator must provide technical assistance to a qualified third-party in the development of the voluntary standard and associated testing protocols for examining lead leaching from new plumbing fittings and fixtures.

In 1996, the National Sanitation Foundation (NSF) developed National Sanitation Foundation/American National Standards Institute (NSF/ANSI) Standard 61, Section 9, which limits the amount of lead that can be leached from endpoint devices for water intended for human consumption (NSF, 2019). The EPA published, in the *Federal Register (FR)* (FR 62 44607; USEPA, 1997), its view that NSF 61, Section 9 satisfied the requirement of SDWA Section 1417(e). Specifically, the EPA found that NSF 61, Section 9 is an established voluntary standard. Therefore, the obligation to issue a new regulation was not triggered. As a result, from August 1997 to January 2014, only those plumbing fixtures and fittings that had a maximum lead content of eight percent and were NSF/ANSI Standard 61, Section 9 certified could be defined as "lead free" per SDWA.

2.1.4 Lead and Copper Rule Minor Revisions (2000)

On January 12, 2000, the EPA published the final Lead and Copper Rule Minor Revisions (65 FR 1950; USEPA, 2000). The goals of the revisions were to streamline requirements, promote consistent national implementation, and in many cases, reduce the burden for community water systems (CWSs) and non-transient non-community water systems (NTNCWSs). The changes affected the following rule requirements: demonstration of optimal corrosion control treatment (OCCT), LSLR, PE, monitoring, analytical methods, reporting and recordkeeping, and special primacy considerations.

2.1.5 2004 National Review of the LCR Leading up to the LCR Short-Term Revisions of 2007

In early 2004, the EPA began a wide-ranging review of the implementation of the LCR in response to high profile action level exceedances (ALEs) experienced by the District of Columbia Water and Sewer

[9] The LCR required PWSs serving more than 50,000 people including those at or below their ALs to install CCT unless they: 1) had completed treatment steps that are equivalent to those described in the 1991 LCR prior to December 7, 1992 or 2) could demonstrate they had very low levels of lead and copper in the distribution system (*i.e.*, qualified as a "b3" system).

Authority (DC Water, formerly known as DC Water and Sewer Authority). For a detailed discussion of the elements of the review and consultations with the NDWAC and other key stakeholders, refer to Section 2.1.5 in Chapter 2 of the EPA's December 2020 *Economic Analysis for the Final Lead and Copper Rule Revisions* (hereafter referred to as the "Final 2021 LCRR EA") (USEPA, 2020a).

2.1.6 Lead and Copper Rule Short-Term Revisions and Clarifications (2007)

The LCR Short-Term Revisions were published in the *Federal Register* on October 10, 2007 (72 FR 57782; USEPA, 2007). This rulemaking contained additional requirements to improve the implementation of the pre-2021 LCR. For additional information, refer Section 2.1.6 in Chapter 2 of the Final 2021 LCRR EA (USEPA, 2020a).

2.1.7 Lead and Copper Rule Revisions (2021)

The 2021 LCRR was published in the *Federal Register* on January 15, 2021 (86 FR 4198; USEPA, 2021b) with an effective date of March 16, 2021, and a compliance date of January 16, 2024. The 2021 LCRR includes a suite of actions to address lead contamination in drinking water to improve the LCR and further reduce lead exposure in comparison with the pre-2021 LCR. The 2021 LCRR created new requirements for:

- Water systems to develop an inventory of their service lines to better understand the number and location of lead service lines (LSLs) in a community.
- Tap sampling to require water systems to sample lead from sites served by LSLs and to collect a fifth-liter sample in lieu of a first-liter sample at LSL sites.
- A lead trigger level (TL) of 0.010 mg/L in addition to the lead AL. Systems that exceed the lead TL must conduct actions sooner that may include a CCT study, adjustment to existing CCT, or initiation of a goal-based LSLR program.
- Improved CCT that requires systems to continue the CCT installation process even if they no longer exceed the lead AL. Also requires systems to implement a find-and-fix approach to evaluate individual sites with lead tap samples above 0.015 mg/L.
- Enhanced LSLR requirements that include a two-year rolling average replacement rate of three percent (that includes lead, galvanized requiring replacement, and unknown service lines) for systems with a lead ALE, a goal-based LSLR program for systems that serve greater than 10,000 people that exceed the lead TL, and the elimination of the test-out provision that allowed LSLs to remain in place if LSL samples do not exceed 0.015 mg/L.
- Small system flexibility for CWSs serving 10,000 or fewer people and all NTNCWSs to select the compliance option that best suits their system including CCT, LSLR, point-of-use (POU) treatment, and replacement of lead-bearing plumbing materials.
- Improved risk communication to require water systems to notify consumers within 24 hours if the system exceeds the AL, to notify consumers whose individual tap sample exceeds 0.015 mg/L within 3 days, and to deliver PE materials to impacted consumers during water-related work that may disturb LSLs. Also includes revisions to the CCT requirements to provide clear

health effects language, a statement on the availability of the service line inventory, and the range of tap sample levels and public access to results.

- CWSs to conduct PE and lead in drinking water testing at elementary schools and child care facilities once over a five-year period and thereafter, conduct monitoring only at these facilities that request testing. Conduct monitoring at secondary schools on request only.

On January 20, 2021, President Biden issued the ‘‘Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis’’ (Executive Order 13990). In response to Executive Order 13990, the EPA reviewed the 2021 LCRR to further evaluate if the rule protects families and communities, particularly those that have been disproportionately impacted by lead in drinking water. The EPA concluded that there are significant opportunities to improve the LCRR. For more details on Executive Order 13990, refer to Section 2.3.1.

2.1.8 Additional Actions to Reduce Lead in Plumbing Materials (2008-present)

An annex to the NSF/ANSI Standard 61 was developed in 2008 that established a standard to determine product compliance with the lead content requirements of California’s Health and Safety Code Section 116875 (commonly known as California Assembly Bill 1953 [AB 1953]), which specifies a maximum weighted average lead content of 0.25 percent calculated across the wetted surface of most plumbing pipe, fittings, and fixtures. Further, more stringent requirements under NSF/ANSI Standard 61 leaching standard (effective July 2012) include lowering the leaching standard from 11 µg/L to 3 µg/L under Section 9 for supply stops, flexible plumbing, connectors, and miscellaneous components, and from 11 µg/L to 5 µg/L for all other Section 9 devices (NSF, 2019).

Congress enacted the Reduction of Lead in Drinking Water Act (RLDWA) (Public Law 111-380) on January 4, 2011, to amend Section 1417 of SDWA to revise the definition of “lead free” in solder, flux, pipe, and fixtures. The law reduced the level of permissible lead in drinking water plumbing fixtures from a maximum of 8 percent to 0.2 percent lead in solder and flux and specifies a maximum weighted average of 0.25 for wetted surfaces of most pipes, fittings, and fixtures. The RLDWA became effective on January 4, 2014. The Community Fire Safety Act of 2013 (Public Law 113-64) further amended Section 1417 to exempt fire hydrants from having to meet the “lead free” requirements under the RLDWA. The EPA announced the final rule titled “Use of Lead Free Pipes, Fittings, Fixtures, Solder, and Flux for Drinking Water “on July 29, 2020 (85 FR 54235; USEPA, 2020b). This rule codified the requirements of the RLDWA and established certification requirements for demonstrating compliance.

2.2 Outreach, Consultation, Workgroup Activities, and Other Events Contributing to the Lead and Copper Rule Revisions

On January 15, 2021, the EPA published in the *Federal Register* the ‘‘National Primary Drinking Water Regulation: Lead and Copper Rule Revisions’’ (86 FR 4198; USEPA, 2021b). The goal for the 2021 LCRR is to improve public health protection provided by the LCR by making substantive changes to the rule based on issues identified through the EPA’s 2004 National Review and as described in the March 2005 Drinking Water Lead Reduction Plan (USEPA, 2005). To help the EPA better define these changes, the agency:

- Held various stakeholder meetings and consultations.

- Charged the SAB to evaluate the effectiveness of partial LSLRs.
- Solicited input from small business stakeholders.
- Continued to consult with NDWAC, whose LCRWG was convened in 2014 and met during 2014 – 2015.
- Consulted with tribal governments.
- Held a public meeting on environmental justice.
- Consulted with State, local government organizations, and PWSs.
- Convened a meeting of high-level staff from the EPA, State, PWS, and non-government organizations (NGOs).

Outreach activities and other events that impacted the 2021 LCRR are discussed in more detail in Sections 2.2.1 through 2.2.10, and summaries and presentation materials, or other documents from meetings and consultations discussed in these sections are available in the docket under EPA-HQ-OW-2022-0801 at https://www.regulations.gov.

2.2.1 Stakeholder Meetings

In October 2008, the EPA held a two-day stakeholder meeting at the Carnegie Institution for Science in Washington, D.C. The purpose of this meeting was to gather stakeholder input on areas to consider in the revisions to the LCR. Stakeholders present at the meeting included State drinking water regulators, members of city level water departments, regional water companies, State health departments, and smaller water testing groups. Discussion topics included changes to the tiering criteria for lead and copper sample site selection LSLR requirements, particulate lead in tap water samples, optimal water quality parameters (OWQPs), tap sampling issues, and CCT technologies. The EPA presented summaries of the scientific data that the agency had compiled on these issues. The EPA also requested stakeholder input and feedback on these and other issues the EPA could consider for potential future action on the LCR.

In November 2010, the EPA held a one-day stakeholder meeting in Philadelphia, PA. Expert participants from utilities, academia, State governments, and other stakeholder groups met to discuss three areas that the EPA considered for revision: tiering criteria for lead and copper sample site selection, LSLR requirements, and potential requirements for testing of lead in drinking water at schools.

2.2.2 Input from Small Business Stakeholders

In July 2012, the EPA solicited input from the Small Business Administration, the Office of Management and Budget (OMB), and nine potentially affected small entity representatives (SERs) on the LCRR, pursuant to the Regulatory Flexibility Act (see Section 7.4). On August 14, 2012, the EPA convened a Small Business Advocacy Review (SBAR) Panel and provided the Panel with input from the SERs. The SBAR Panel submitted its report to the EPA in October 2012, which incorporated additional input from the SERs. The report provided the number and type of small entities that may be affected by the proposed rule; a recommendation to consider CCT techniques other than orthophosphate due to

possible conflicts with National Pollutant Discharge Elimination System permit limits for phosphorus; and alternatives that would minimize any significant economic impact of the proposed rule on small entities. Specifically, the Panel submitted recommendations regarding the sample site selection criteria, PE for copper, the process for re-evaluating and revising CCT, copper monitoring waivers for systems that can demonstrate their water is non-aggressive toward copper; POU treatment units in lieu of CCT for NTNCWSs serving 10,000 or fewer people; the sampling protocol at sites served by LSLs; and mandatory LSLR requirements.

2.2.3 Input from SAB and NDWAC

Throughout the LCRR rulemaking process, the EPA consulted with the SAB and the NDWAC. Sections 2.2.3.1 and 2.2.3.2 provide a summary of the EPA's consultations with the SAB and with the NDWAC, respectively.

2.2.3.1 SAB Review

The SAB provides scientific advice to the EPA Administrator including reviewing the quality and relevance of the scientific and technical information being used by the EPA or proposed as the basis for agency regulations. This section describes consultations with the SAB during 2011 and 2020 on the LCRR.

2.2.3.1.1 2011 SAB Consultation

The EPA formally charged the SAB to review and provide advice regarding studies examining the effectiveness of partial LSLRs. The SAB held a public meeting on this review on March 30 and 31, 2011 in Washington, D.C. with a follow up conference call on May 16, 2011. SAB's final report, entitled "SAB Evaluation of the Effectiveness of Partial Lead Service Line Replacements" was transmitted along with a memorandum to the EPA Administrator on September 28, 2011 (USEPA, 2011a).

2.2.3.1.2 2020 SAB Review of the Proposed LCRR

Following the LCRR proposal, the SAB elected to review the scientific and technical basis of the proposed rule, on March 30, 2020. The drinking water sub workgroup took the lead in the SAB deliberations on this topic at a public teleconference held on May 11, 2020. The SAB provided advice and comments in its June 12, 2020 report (USEPA, 2020c). SAB comments were similar to those raised by public commenters. A copy of the report is included in the docket for the rule.

2.2.3.2 NDWAC Meetings

The NDWAC is a Federal Advisory Committee that supports the EPA in performing its duties and responsibilities related to the national drinking water program and was created through a provision in the SDWA in 1974. In accordance with Section 1412(d) and (e) of the SDWA, the EPA consulted with the NDWAC on efforts to develop revisions to the LCR. These consultations are further described in this section.

2.2.3.2.1 2011 NDWAC Consultation

On November 18, 2011, the EPA held a public teleconference with NDWAC to discuss a study completed by the Centers for Disease Control and Prevention as well as to address the SAB evaluations regarding partial LSLR. In December 2011, the NDWAC held a 2-day public meeting to address various issues

associated with drinking water protection including actions to assist small water systems. The NDWAC provided the EPA with recommendations on the potential LCR regulatory revisions, which are outlined in a letter dated December 23, 2011 (NDWAC, 2011).

2.2.3.2.2 2013 NDWAC Consultation

In December 2013, the EPA met with the NDWAC in Washington, D.C. to provide a national drinking water program update (NDWAC, 2013). The EPA provided background on the LCRR and highlighted for the Council five areas where the EPA was considering a range of regulatory revisions and seeking detailed stakeholder input. The five areas were: 1) sample site selection criteria for tap monitoring, 2) lead sampling protocol, 3) copper PE, 4) measure to ensure OCCT, and 5) LSLR. The public also had an opportunity to provide information to the NDWAC on issues with which they were concerned and wanted to be considered in the rule revisions. During this meeting, the EPA formally requested that the NDWAC form a working group to support the EPA in the development of the LCRR. The NDWAC unanimously voted on forming this working group. A summary of these LCRWG meetings is provided in the next section.

2.2.3.2.3 2014 – 2015 NDWAC LCRWG Meetings

The NDWAC formed the LCRWG to provide additional advice to the EPA on potential options for the LCRR. The 15-member LCRWG consisted of representatives from States, water systems, health agencies, and public interest groups. The LCRWG held seven in-person meetings from March 2014 through June 2015, participated in multiple conference calls, and spent time outside these meetings to provide input to the NDWAC on the five key issues that the EPA identified during the December 2013 NDWAC meeting. The LCRWG also provided additional recommendations on other areas such as expanded lead education and outreach and the need to engage other stakeholders that include the health community.

The LCRWG provided their final report, including recommendations, to the larger NDWAC committee in August 2015 (NDWAC, 2015a) and presented their recommendations to the NDWAC in November 2015. The NDWAC accepted the LCRWG recommendations and submitted their recommendation via letter to the EPA on December 15, 2015 (NDWAC, 2015b).

In the report, the NDWAC acknowledged that reducing lead exposure is a shared responsibility among consumers, PWSs, building owners, public health officials, and others. In addition, they recognized that creative financing is necessary to reach the LSL removal goals, especially for disparate and vulnerable communities. The NDWAC advised the EPA to maintain the LCR as a treatment technique rule but with enhanced improvements. The NDWAC qualitatively considered costs before finalizing its recommendations, emphasizing that PWSs and States should focus efforts where the greatest public health protection can be achieved and incorporating their anticipated costs in their capital improvement program or the requests for Drinking Water State Revolving Funds (DWSRF). The LCRWG outlined an extensive list of recommendations for the LCRR including establishing a goal-based LSLR program, strengthening CCT requirements, and tailoring water quality parameters (WQPs) to the specific CCT plan for each water system.

The report the NDWAC provided for the EPA also included recommendations for renewed collaborative commitments between all levels of government and the public while recognizing the EPA's leadership role in this area. These complementary actions as well as a detailed description of the provisions for NDWAC's recommendations for the proposed rule can be found in the "Report of the Lead and Copper

Rule Working Group to the National Drinking Water Advisory Council" (NDWAC, 2015a). One member of the NDWAC working group provided a dissenting opinion (Parents for Nontoxic Alternatives, 2015). The EPA took into consideration the NDWAC's recommendations and the dissenting opinion when developing the final revisions to the LCR.

2.2.3.2.4 2019 NDWAC Consultation

On December 4-5, 2019, the EPA held a NDWAC meeting in Washington, D.C. where the EPA presented the proposed LCRR. In the presentation, the major LCR revisions were highlighted (*e.g.,* the LSL inventory, the new TL of 10 µg/L, and new sampling protocols). The presentation focused on six key areas: identifying areas most impacted, strengthening treatment requirements, replacing LSLs, increasing sampling reliability, improving risk communication, and protecting children in schools. The EPA reiterated the LCRR was developed with extensive consultation from State, local, and tribal partners to identify opportunities that would reduce elevated levels of lead in drinking water. The EPA reaffirmed its commitment to transparency and improved communication to the public.

2.2.4 Consultation with Tribal Governments

Consistent with the EPA Policy on Consultation and Coordination with Indian Tribes (May 4, 2011), the EPA consulted with tribal officials during the development of the LCRR to gain an understanding of tribal views of potential revisions to key areas of the LCR (USEPA, 2011b). The EPA coordinated and consulted with federally-recognized Indian tribes on the LCR proposed regulatory revisions, pursuant to Executive Order 13175, *Consultation and Coordination With Indian Tribal Governments* (65 FR 67249, November 9, 2000) (see Chapter 7, Section 7.7). Any revisions to the LCR will impact a tribal government that operates a PWS or that has primary enforcement authority for PWSs on tribal lands. The EPA requested input from tribal governments on how the agency should revise the LCR while maintaining or improving public health protection. The EPA held tribal consultations, beginning with a national tribal consultation teleconference on December 1, 2011 to obtain input from tribal governments on the proposed LCRR and to determine which revisions would assist tribal governments in implementing and complying with the rule while maintaining or improving public health.

From January 16 to March 16, 2018, the EPA held a consultation with federally-recognized Indian tribes. The EPA sent a consultation invitation letter to all 567 federally-recognized tribes along with a consultation and coordination plan, a link to written technical background information, and an invitation to two national webinars for tribes. The first national webinar was held January 31, 2018, and a second national webinar was held February 15, 2018. A total of 48 tribal representatives participated in the two webinars. Updates on the consultation process were provided to the National Tribal Water Council, upon request, at regularly scheduled monthly meetings during the consultation process. Also, upon request, informational webinars were provided to the National Tribal Toxics Council's Lead Subcommittee on January 30, 2018, and the EPA Region 9's Regional Tribal Operations Committee on February 8, 2018. The information presented included key challenges to the previous LCR and potential revisions regarding LSLR, CCT, tap sampling, PE and transparency, and copper requirements.

Five tribes or tribal organizations (Navajo Tribal Utility Authority, National Tribal Water Council, United South and Eastern Tribes Sovereignty Protection Fund, Yukon River Inter-Tribal Watershed Council, and Indian Health Service – Sanitation Facilities Construction, Seattle Office) submitted written consultation

comments to the EPA.[10] A summary report of the views expressed during tribal consultations is available in the docket (EPA-HQ-OW-2022-0801) at www.regulations.gov.

2.2.5 Public Meeting on Environmental Justice

During March 2011, the EPA held a public meeting to discuss and solicit input on environmental justice considerations related to several upcoming regulatory efforts that included the LCRR. The meeting was attended in-person and remotely by a diverse group including advocacy groups, water systems, State agencies and trade associations, and private corporations. LSLR was a main area of discussion during this meeting. The EPA provided information on the LCR and rule revisions that the agency was considering to alleviate disproportionate impacts. The EPA also solicited input from the public regarding ways in which the agency could further consider environmental justice concerns in the LCR revision process.

2.2.6 Consultation with State and Local Government Organizations

This section provides information on the EPA's 2011 and 2018 federal consultations and interactions with the Association of State Drinking Water Administrators (ASDWA) on development of the LCRR.

2.2.6.1 November 2011 Federalism Consultation

On November 15, 2011, the EPA held a Federalism consultation with representatives from State and local government organizations to solicit feedback on potential regulatory revisions to the LCR, pursuant to Executive Order 13132, *Federalism* (64 FR 43255, August 10, 1999) (see Chapter 7, Section 7.6).

In its capacity as an advisory committee to the EPA, the Local Government Advisory Committee periodically makes recommendations and comments to the agency on issues impacting local governments. The EPA received comments that addressed sample site collection criteria and lead sampling protocol at LSL sites.

2.2.6.2 ASDWA Questionnaire to States on Possible LCRR Requirements

In 2016, ASDWA developed a State questionnaire regarding potential LCRR requirements. The purpose of the questionnaire was to obtain labor and cost estimates associated with some of the pre-2021 LCR and potential requirements under the proposed LCRR to include in the Proposed LCRR EA (USEPA, 2019). States were questioned about pre-2021 LCR oversight activities and additional implementation (*i.e.*, sampling invalidation, WQP monitoring, CCT re-assessment, changes in source or treatment, and LSLR). In terms of possible LCRR oversight activities, States were asked about burden and costs associated with lead sampling instructions, updating the materials inventory, annual review of lead information, discussion of sampling data during sanitary surveys, water aggressiveness to copper determinations, drinking water treatment process control charting, periodic review of updated CCT guidance, and how systems could demonstrate they had no LSLs. Two States (Indiana and North Carolina) responded to the questionnaire.

[10] More information on LCR-specific tribal consultation is available at the EPA's LCR website: http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/index.cfm.

2.2.6.3 Questionnaire to States on LSL Inventory and Other LSL-Related Information

In 2017, the EPA disseminated a questionnaire to nine States regarding the burden and cost associated with NDWAC's recommendation to require all systems to develop a comprehensive LSL inventory and to expand the definition of an LSL to include lead connectors even if the service line is not made of lead. The questionnaire asked States how they would manage the LSL inventory requirement and their estimates for costs associated with reviewing PWS inventory documentation. The nine States were selected based on geographic diversity, high incidence of LSLs, and knowledge of existing LSLR programs. Seven States (Illinois, Michigan, New Jersey, Ohio, Rhode Island, Washington, and Wisconsin) out of the nine States responded to the questionnaire.

2.2.6.4 January 2018 Federalism Consultation

Pursuant to Executive Order 13132, *Federalism*, the EPA held an initial Federalism meeting on January 8, 2018 in Washington, D.C. with 17 intergovernmental associations and several associations representing State and local governments.[11] EPA provided the associations' membership an opportunity to provide input during follow-up meetings. The EPA also held five follow-up briefings between January 8 and March 8, 2018. A total of 82 State and local governments and related associations provided input during the meetings and within 60 days after the initial meeting. The EPA received comments from 24 municipal water utilities, 21 local government agencies, 20 intergovernmental associations, 15 State agencies, and two Members of the United States House of Representatives. Common issues discussed included LSLR, CCT, transparency and PE, tap sampling, and copper.

A summary report of the views expressed during Federalism consultations is available in the docket (EPA-HQ-OW-2022-0801) at www.regulations.gov.

2.2.6.5 Meetings with ASDWA

This section describes the EPA's meetings with ASDWA during August 2018 to further discuss their Federalism comments and March 2020 on projected State costs to implement the possible revisions to the LCR.

2.2.6.5.1 August 2018 Meeting

The EPA met with ASDWA in August 2018 to further discuss ASDWA's comments provided during the Federalism consultation period discussed above. The EPA gave an abbreviated version of the Federalism presentation for the ASDWA members, highlighting the major topics the EPA was contemplating for revision for the LCR. ASDWA presented preliminary estimates of State costs for CCT-related activities, including State review of CCT and find-and-fix activities. ASDWA noted that they planned to continue to refine their estimates and analysis and to eventually conduct a survey of their members. The EPA and ASDWA also discussed LSLR, CCT, transparency and PE, tap sampling, and copper.

[11] For more information regarding the LCR Federalism Consultation, refer to: https://www.epa.gov/dwstandardsregulations/lcr-federalism-consultation.

2.2.6.5.2 March 2020 Meeting

The EPA met with ASDWA during March 2020 to discuss revisions to their 2018 Costs of State Transactions Study (CoSTS) (ASDWA, 2018). The model projected the increase in the States' workload from the anticipated revisions to the LCR. ASDWA submitted the 2018 version of the model during the Federalism consultation and submitted a revised version to the EPA during the public comment period for the proposed rule. The EPA revised several of its costing inputs used for the proposed rule to reflect information provided in ASDWA's 2020 version of CoSTS (ASDWA, 2020). The file, "Final CoSTS 2-6-20.xlsx" is available in the LCRR docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

2.2.7 Public Water Systems

The lead in drinking water crisis in Flint, MI[12] brought increased attention to lead in drinking water and to the need to improve the pre-2021 LCR. It underscored significant challenges in the implementation of the pre-2021 LCR, including a rule structure that for many systems only compels protective actions after public health threats have been identified (USEPA, 2016a). The EPA took into account the experience in Flint, MI in developing the LCRR. In addition, the EPA solicited input from other PWSs across the country regarding burden and costs of potential revisions to consider in the development of the LCRR. A summary of the input from PWSs (through the dissemination of surveys and questionnaires) is discussed in Section 2.2.7.1.

2.2.7.1 Input from PWSs

The EPA sought input from PWSs regarding the cost and burden of potential provisions in the LCRR. Specifically, the EPA issued questionnaires to the New York City Department of Environmental Protection and the Chicago Department of Water Management about their free lead in drinking water testing program and to nine systems regarding their LSL inventories. The EPA also met with systems by phone to obtain information. The EPA met with Greater Cincinnati Water Works (GCWW) about their school testing program for lead in drinking water and with the Philadelphia Water Department (PWD) regarding their protocol to address high lead levels at individual households. Each of these is discussed in more detail in the following sections.

2.2.7.1.1 New York City Department of Environmental Protection and Chicago Department of Water Management

The EPA sent a questionnaire in 2016 to the New York City Department of Environmental Protection and the Chicago Department of Water Management regarding their free testing programs for lead in drinking water. The purpose of this questionnaire was to give the EPA a sense of the burden and cost associated with implementing such a program. In particular, the questionnaire asked about when these programs were started, methods of advertising and communication, how many customers requested sampling per year, percentage of sample results that exceeded the lead AL, public accessibility of the lead results, and other types of testing and analyses offered to customers.

[12] See, https://www.epa.gov/flint for additional information on the EPA's Flint drinking water response along with website links to additional information. Also see, https://www.cdc.gov/nceh/lead/programs/flint-registry.htm, the Centers for Decease Control and Preventions' voluntary Flint lead exposure registry website.

2.2.7.1.2 LSL Inventory and LSLR Questionnaire

The EPA sent a questionnaire to nine PWSs with active LSLR programs. The questionnaire was designed to obtain information about the activities and costs needed to develop a comprehensive LSL inventory, how systems have achieved successful LSLR programs, and the cost associated with LSLR. Fort Worth was the only PWS to respond to the questionnaire.

2.2.7.1.3 Greater Cincinnati Water Works

On May 25, 2018, the EPA met with GCWW to discuss their proactive school testing program for lead in drinking water. Representatives from GCWW provided an overview of the program and discussed the services offered to schools, the roles of other agencies in the program, and the integration of child cares into the program. GCWW also provided the EPA with an Excel spreadsheet that outlined the steps taken to sample at a school, average time it takes to complete each step, and the average cost per school.

2.2.7.1.4 Philadelphia Water Department

The EPA met with PWD on November 2, 2018 to discuss how the system addresses high lead levels at individual residences. PWD served on the NDWAC LCRWG and indicated that PWD conducts find-and-fix steps when LCR compliance sampling yields high lead results. During this meeting, PWD discussed its free lead tap sampling program for customers who request testing. PWD also provided the EPA with some of its lead PE materials.

2.2.8 EPA Letter to Governors and State Environment and Public Health Commissions and Tribal Leaders

In 2016, the EPA sent letters to Governors, State Environment and Public Health Commissioners, and Tribal Leaders regarding the LCR.[13] The intent of the letters was to ensure that the LCR was being properly implemented. In the letter, the EPA explained their immediate effort to oversee State implementation of the LCR and to work with States to identify ways to strengthen implementation and ultimately improve public health protection. The letter also asked these parties to take action to improve public transparency and accountability in the implementation of the rule.

2.2.9 Administrator's Meeting with States, PWS, and Non-Government Organizations

In May and June of 2016, the Administrator and other high-ranking EPA officials conducted meetings with State officials, water system officials, and NGOs. Sixteen State officials and 16 PWS officials met with the EPA on May 26 and June 1, 2016, respectively. The EPA met with 15 NGOs on June 2, 2016. During each meeting, the EPA and stakeholder officials discussed critical needs and key opportunities for addressing drinking water challenges and four priority issues including the LCR with the goal of strengthening implementation of the pre-2021 LCR and improving public health protection through updates to the rule. The results of these meetings informed the EPA's Drinking Water Action Plan, published in November 2016 (USEPA, 2016b).

[13] For templates of these letters and stakeholder responses, refer to: https://www.epa.gov/dwreginfo/epa-letter-governors-and-state-environment-and-public-health-commissioners.

2.2.10 Public Comments on the Proposed LCRR

Following publication of the proposed LCRR, the EPA accepted public comments for 90 days. The EPA received comments from over 79,000 individuals and organizations representing a wide range of stakeholders, including PWSs, States, tribes, other organizations, and private citizens. Each unique comment was read and considered in determining the final rule requirements. A record of the comments received on the proposal, as well as the EPA's responses to these comments, can be found in the "Public Comment and Response Document for the Final Lead and Copper Rule Revisions" (USEPA, 2020d). Copies of unique individual comments are also available as part of the public record and can be accessed through the EPA's docket (EPA-HQ-OW-2017-0300 at www.regulations.gov).

2.3 Outreach, Consultation, and Other Engagements Contributing to the Proposed Lead and Copper Rule Improvements

This section provides a summary of the EPA's engagements that occurred as part of the LCRR Review (Section 2.3.1) and engagements and consultations held to support the development of the proposed LCRI (Section 2.3.2). The EPA's summaries and presentation materials, or other documents from meetings and consultations discussed in these sections are available in the docket for the proposed rule under EPA-HQ-OW-2022-0801 at https://www.regulations.gov.

2.3.1 LCRR Review

On January 15, 2021, the EPA published in the *Federal Register* the "National Primary Drinking Water Regulation: Lead and Copper Rule Revisions" (86 FR 4198; USEPA, 2021b) with an effective date of March 16, 2021, and a compliance date of January 16, 2024. On January 20, 2021, President Biden issued the "Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis" (Executive Order 13990).

Section 1 of Executive Order 13990 states that it is "the policy of the Administration to listen to the science, to improve public health and protect our environment, to ensure access to clean air and water . . . , and to prioritize both environmental justice and the creation of the well-paying union jobs necessary to deliver on these goals." Executive Order 13990 directs the heads of all Federal agencies to immediately review regulations that may be inconsistent with, or present obstacles to, the policy it establishes. On March 12, 2021, the EPA published the National Primary Drinking Water Regulations: Lead and Copper Rule Revisions; Delay of Effective Date (86 FR 14003; USEPA, 2021c), which delayed the effective date of the LCRR from March 16, 2021, to June 17, 2021. On the same day, the EPA published the National Primary Drinking Water Regulations: Lead and Copper Rule Revisions; Delay of Effective and Compliance Dates (86 FR 14063; USEPA, 2021d), which proposed further delaying the effective date of LCRR to December 16, 2021 to allow the EPA to "conduct a review of the LCRR and consult with stakeholders, including those who have been historically underserved by, or subject to discrimination in, Federal policies and programs prior to the LCRR going into effect" (86 FR 14063; USEPA, 2021d). On June 16, 2021, the EPA published a final rule, the National Primary Drinking Water Regulations: Lead and Copper Rule Revisions; Delay of Effective and Compliance Dates (86 FR 31939; USEPA, 2021e), which delayed the LCRR effective date until December 16, 2021, and the compliance date until October 16, 2024. While the LCRR was delayed, the EPA engaged with stakeholders to better understand their thoughts and concerns about the LCRR.

The EPA hosted a series of virtual engagements from April to August 2021 to obtain public input on the review of the LCRR. The EPA also opened a docket, from April 5, 2021, to July 30, 2021, to accept written comments, suggestions, and data from the public. Summaries of these engagements, including summaries of the meetings and written comments, can be found in the docket, the EPA-HQ-OW-2021-0255 at https://www.regulations.gov/. Recordings of the public listening sessions and community, tribal, and national stakeholder association roundtables can also be found in the docket. The virtual engagement meetings included two public listening sessions, 10 community roundtables, a tribal roundtable, a national stakeholder association roundtable, a national co-regulator meeting, and a meeting with organizations representing elected officials.

The EPA specifically sought engagement with communities that have been disproportionately impacted by lead in drinking water, especially lower-income people and communities of color that have been underrepresented in past rule-making efforts. The EPA hosted roundtables with individuals and organizations from Pittsburgh, Pennsylvania; Newark, New Jersey; Malden, Massachusetts; Washington, D.C.; Newburgh, New York; Benton Harbor and Highland Park, Michigan; Flint and Detroit, Michigan; Memphis, Tennessee; Chicago, Illinois; and Milwaukee, Wisconsin. These geographically-focused roundtables included a range of participants including local government entities, community organizations, environmental groups, local public water utilities, and public officials. The EPA worked with community representatives to develop meeting agendas that reflected community priorities. Each community roundtable included a presentation by local community members. The EPA held a separate roundtable with representatives from tribes and tribal communities. Participants in all roundtables were invited to share diverse perspectives with the agency through verbal discussion and a chat feature. The EPA obtained detailed, valuable feedback from these engagements, which often focused on the lived experiences of people impacted by lead in drinking water.

On December 17, 2021, the EPA published its findings from the review that included specific areas on which commenters provided feedback and the agency’s intention to develop a new rule to revise the LCRR (86 FR 71574, USEPA, 2021a). Specific areas on which commenters provided feedback included:

- Concern that the LCRR would not provide equitable public health protections, may create confusion about drinking water safety, and would be difficult to implement.
- The topic of 100 percent LSLR including the replacement timeframe and obstacles to achieving it.
- The lead AL and TL including whether to lower the AL and/or remove the TL.
- Tap sampling requirements for systems with LSLs.
- Requiring accessible PE materials and outreach to residents about lead risk and suggestions for achieving this goal.
- Water testing at schools and child care facilities.
- Suggestions for revising the CCT, WQP and find-and-fix requirements.
- Limiting the small system flexibility provisions.

2.3.2 Consultations and Engagements to Support the Development of the Proposed LCRI

The EPA held consultations and engagements September 2022 through August 2023 to obtain additional feedback on areas the EPA identified for improvement during the LCRR Review. These consultations and engagements are provided in more detail in Sections 2.3.2.1 through 2.3.2.7.

2.3.2.1 Small Business Stakeholders

On September 12, 2022, the EPA conducted a SBAR pre-panel outreach meeting to solicit input from 11 SERs on the potential small systems implications of the forthcoming proposed LCRI.[14] EPA received verbal comments from seven small entities and written comments from four small entities. SER comments included challenges in achieving 100 percent LSLR in small systems including acquiring contractor support, engaging customers and local governments, financial and administrative burden, incorporating equity, and service line ownership issues. SERs also provided comments on complying with a revised TL and AL construct, complying with revised tap sampling protocol, the need for national training and technical assistance, concerns with school and child care facility sampling, small system flexibility, issues with public notification requirements, opportunities to reduce burden through clarifications, and simultaneous compliance with other rules.

On November 29, 2022, the EPA convened a second SBAR outreach panel to solicit further input from SERs. A total of eight SERs attended the meeting, with six providing verbal comments and six providing written comments following the meeting. The comments included incorporating equity into LSLR, importance of funding and support, and challenges of service line ownership. SERs also provided comments on challenges in collecting first- and fifth-liter samples, relating tap monitoring results to risk communication and CCT, the effect of the AL on tier 1 public notice, and simplifying the rule. Additional comments included concerns for schools, risk reduction through filters and bottled water, the rule implementation timeframe, and additional regulatory flexibility including compliance options for water corrosivity and LSLR and compliance options for low- or no-lead systems. The SBAR panel submitted its report to the EPA on May 31, 2023.

2.3.2.2 Public Meeting on Environmental Justice

The EPA held two public meetings related to environmental justice (EJ) and the development of the proposed LCRI on October 25, 2022, and November 1, 2022. These sessions provided opportunities for the EPA to share information about the upcoming LCRI rulemaking and for individuals to offer input on EJ considerations related to the rule. During the meeting, the EPA presented a brief overview of lead health effects, lead occurrence in drinking water, and the SDWA process for developing a drinking water regulation, in particular highlighting the EJ-related components. The EPA received public input through verbal and written public comments, as well as interactive polling responses. The EPA received a total of 30 public comments during the 60-day post meeting comment period. Public comments included incorporating equity into 100 percent LSLR replacement goals, methods of identifying and prioritizing disadvantaged communities who are disproportionately impacted by lead in in drinking water for LSLR, and methods of overcoming customers' financial and access barriers to full LSLR. A summary report of

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[14] For more information about the SBAR panel, visit https://www.epa.gov/reg-flex/potential-sbar-panel-national-primary-drinking-water-regulation-lead-and-copper-rule

the views expressed during both EJ consultations is available in the docket (EPA-HQ-OW-2022-0801) at www.regulations.gov.

2.3.2.3 Consultation with Tribal Governments

The EPA initiated consultations and coordination with federally recognized Indian tribes to obtain input on the agency's proposed LCRI, pursuant to Executive Order 13175, *Consultation and Coordination With Indian Tribal Governments* (Executive Order 13175). The EPA signed a tribal consultation notification letter inviting tribal officials to participate in consultation and coordination events and provide comments to the EPA, and emailed this letter to all 574 federally-recognized tribal leaders at that time. In addition to the consultation invitation letter, the EPA provided a consultation and coordination plan background information, and an invitation to two national informational webinars for tribal governments. All tribal consultation materials were made available via the EPA's Tribal Consultation Opportunities Tracking System (https://tcots.epa.gov).

The national informational webinars were held on October 27, 2022, and November 9, 2022. Consistent with the EPA Policy on Consultation and Coordination with Indian Tribes (May 4, 2011), the EPA consulted with tribal officials to gain an understanding of tribal views of key areas of the proposed LCRI. As part of the meeting, the EPA representatives presented background information on the pre-2021 LCR and LCRR regulations regarding lead and copper content in drinking water. The EPA also presented on the rule considerations for the proposed LCRI. During the consultation process, the EPA requested input from tribal governments on considerations to inform the development of the proposed LCRI, including elements related to potential regulatory requirements and suggestions that would assist tribal governments in implementing and complying with the rule. Four specific areas of the proposed rule on which the EPA requested input included achieving 100 percent LSLR, tap sampling and compliance, reducing rule complexity, and small system flexibility.

A total of 11 tribal representatives participated in the two webinars. Webinar participants provided verbal comments, but the EPA did not receive any written consultation comments from tribal organizations during the comment period that followed the webinars.

2.3.2.4 SAB Consultation

The EPA consulted with the 37 members of the SAB on the key areas being considered for the proposed LCRI and tools, indicators, and measures for use in future analyses to determine EJ impacts of LSL presence and replacement in drinking water systems. Prior to the meeting, which was held on November 3, 2022, the EPA provided the charge to the SAB and shared the agency's preliminary analyses and draft results on case studies for three cities to help inform the agency's EJ analysis for the proposed LCRI (USEPA, 2022). The EPA charged the SAB with the following three questions:

- Are there potential EJ concerns associated with environmental stressors affected by the regulatory action for population groups of concern in the baseline?
- Are there potential EJ concerns associated with environmental stressors affected by the regulatory action for population groups of concern for each regulatory option under consideration?

- For each regulatory option under consideration, are potential EJ concerns created or mitigated compared to the baseline?

The SAB provided initial verbal advice and comments on the proposed rule and case studies, as well as written comments through November 21, 2022. The SAB provided its final report to the EPA Administrator on December 20, 2022, regarding the agency's EJ analysis for LCRI (USEPA SAB, 2022).

2.3.2.5 NDWAC Consultation

On December 1, 2022, the EPA held a public teleconference with NDWAC during which the EPA presented the proposed LCRI and solicited input from the NDWAC. The EPA provided background on lead in drinking water and the LCR, an overview of the LCRR published in January 2021, annualized cost estimates from the LCRR EA, and a summary of the outcome of the EPA's review of the LCRR. The NDWAC provided key input on four key areas: achieving 100 percent LSLR, tap sampling and compliance, reducing rule complexity, and small system flexibility. The public was also given an opportunity to provide their comments to the NDWAC.

2.3.2.6 2022 Federalism/Unfunded Mandates Reform Act (UMRA) Consultation

The Federalism Consultation began on October 13, 2022, and ended on December 13, 2022. On September 29, 2022, the Director of the Office of Ground Water and Drinking Water (OGWDW), Jennifer McLain, signed a Federalism consultation notification letter inviting State and local government officials as well as their representative associations to participate in a meeting and consultation and provide comments to the EPA during the consultation process. The EPA sent this letter to a number of State and local agencies as well as several water and utility professional organizations that may have State and local government members.

The EPA held the Federalism and UMRA meeting on October 13, 2022. During the meeting, the EPA presented background information and questions for feedback on key areas of the proposed rule. The EPA specifically requested input on the following key rule areas: achieving 100 percent LSLR, tap sampling and compliance, reducing rule complexity, and small system flexibility. Fifteen organizations, as well as several associations with expertise in drinking water, were represented at the Federalism/UMRA consultation meeting. Although this virtual briefing was for intergovernmental association staff only, participants were able to schedule follow-up briefings for their memberships and were encouraged to forward the briefing information and materials to their members. The EPA provided a 60-day public comment period following the October 13, 2022 meeting.

2.3.2.7 Meetings with ASDWA

The EPA met with ASDWA on October 5, 2022, to solicit feedback from State co-regulators on the development of LCRI. A total of 21 State co-regulators from 16 States participated in this early engagement meeting, in addition to 5 representatives from ASDWA and 10 representatives from the EPA OGWDW. The EPA representatives presented background regarding the pre-2021 LCR, an overview of LCRR, and cost information for actions to reduce drinking water lead levels. ASDWA and State co-regulators discussed how quickly systems can achieve 100 percent LSLR, factors that impact a system's rate of LSLR, barriers to engaging customers for full LSLR, and how systems can ensure equity in replacements.

The EPA held a second meeting with ASDWA on November 2, 2022, at which a total of 18 co-regulators from 15 States participated, in addition to 5 representatives from ASDWA and 6 representatives from the EPA OGWDW. The EPA representatives asked ASDWA and State co-regulators to provide feedback on tap sampling and compliance and opportunities to reduce complexity mainly around the AL and TL construct. In addition to these topics, ASDWA and State co-regulators discussed CCT, WQPs, find-and-fix provisions, school and childcare sampling, PE, and Safe Drinking Water Information System (SDWIS) capabilities to track data.

2.3.2.8 HHS Consultation

On August 18, 2023, the EPA conducted a virtual consultation meeting with the Department of Health and Human Services (HHS) on the proposed LCRI. The purpose of the meeting was to provide an overview of the proposed rule and to allow participants to ask clarifying questions. HHS participants sought clarifications on full LSLR, justification for changing the lead AL, factors influencing water systems' ability to meet the lead AL, regulatory authority over schools and child care centers, lead tap sampling in schools and child care centers, language accessibility of PE materials, small system flexibilities, use of LSL inventory data, materials used to replace LSLs, and resources for protecting workers during LSLR. The EPA considered HHS input as part of the interagency review process.

2.3.3 Public Water Systems

On December 7, 2023, the EPA sent a questionnaire to nine water systems regarding the burden and cost to develop and maintain a service line inventory under the LCRR. The EPA requested feedback by February 28, 2023, and received responses from three water systems, Grand Rapids, Michigan; Pittsburgh, Pennsylvania; and Cincinnati, Ohio (USEPA, 2023a). As explained in Chapter 5, Section 5.3.4.1, the EPA used the information from these three water systems among other sources to help develop burden and cost related to service line inventory updates and validation.

2.4 Outreach, Consultation, and Other Engagements Contributing to the Final Lead and Copper Rule Improvements

This section provides a summary of the EPA's engagements, consultations, and opportunity for public comment that occurred to support finalizing the LCRI. The EPA's summaries and presentation materials from meetings and consultations discussed in these sections are available at the EPA's website https://www.epa.gov/ground-water-and-drinking-water/proposed-lead-and-copper-rule-improvements and are available in the docket for the proposed rule under EPA-HQ-OW-2022-0801 at https://www.regulations.gov.

2.4.1 Informational Webinar and Public Hearing

This section provides a summary of two webinars and a public hearing on the proposed LCRI that are discussed in more detail in Section 2.4.1.1 through Section 2.4.1.3. The EPA's summaries and presentation materials from these meetings are available at the EPA's website https://www.epa.gov/ground-water-and-drinking-water/proposed-lead-and-copper-rule-improvements.

2.4.1.1 Webinar on Preparing Communities to Engage in the Proposed LCRI Regulatory Process

On October 17, 2023, the EPA held a webinar to provide information to the public on how to participate in the rulemaking process and how to offer the EPA input on the proposed LCRI.

2.4.1.2 Informational Webinar

On December 6, 2023, the EPA held an informational webinar on the proposed LCRI and to provide information on the public comment period and how the public can submit their comments to the docket.

2.4.1.3 Public Hearing

On January 16, 2024, the EPA held a virtual public hearing to provide an opportunity for the public to share their input on the proposed LCRI. Members of the public were notified of the public hearing on December 6, 2023, through the Proposed LCRI *Federal Register* Notice and on the EPA's LCRI website. Eighty-two individuals or organizations provided testimony. Their comments were considered equally to the written public comments received through the docket (see Section 2.4.2). Their comments can be accessed through the docket at https://www.regulations.gov/comment/EPA-HQ-OW-2022-0801-2268.

2.4.2 Public Comments on the Proposed LCRI

Following publication of the proposed LCRI on December 6, 2023 (USEPA, 2023b), the EPA accepted public comments for 60 days. The EPA received nearly 200,000 comments from individuals or organizations representing a wide range of stakeholders, including PWSs, States, tribes, other organizations, and private citizens. Each unique comment including those from the January 16, 2024 public hearing were read and considered in determining the final rule requirements. A record of the comments received on the proposal, as well as the EPA's responses to these comments, can be found in the *Public Comment and Response Document for the Final Lead and Copper Rule Improvements* (USEPA, 2024a). Copies of unique individual comments are also available as part of the public record and can be accessed through the EPA's docket (EPA-HQ-OW-2022-0801 at www.regulations.gov).

2.4.3 Input from NDWAC

On January 31, 2024, the EPA held a public teleconference to consult with the NDWAC on five key areas for the final rule: (1) achieving 100 percent lead pipe replacement within 10 years, (2) locating legacy pipe, (3) improving tap sampling and compliance, (4) lowering the lead AL, and (5) strengthening protection to reduce exposure. The public was also given an opportunity to provide their comments to the NDWAC. A summary of the NDWAC meeting, the public comments to the NDWAC, and the EPA's presentation are available in the NDWAC Summary Report (NDWAC, 2024) and is also available in the docket.

2.4.4 HHS Consultation

On July 15, 2024, the EPA consulted with HHS for the final LCRI. The purpose of the meeting was to provide an overview of the final rule and to allow participants to ask clarifying questions. HHS participants sought clarifications on developing equitable service line replacement plans, public

availability of the service line inventory, communication with consumers about identification of lead status unknown service lines, communication with health care providers about lead and steps to protect health, lead tap sampling results in schools and child care facilities, requirements for water systems with multiple lead action level exceedances, EPA communication with National Institutes of Health (NIH) on occurrence of lead action level exceedances, and communications materials around promulgation of the final rule. The EPA considered HHS input as part of the interagency review process in accordance with Executive Order 12866: Regulatory Planning and Review.

2.5 Statutory Authority for Promulgating the Rule

The EPA derives its statutory authority to regulate contaminants in drinking water through the SDWA. The SDWA requires the EPA to establish MCLGs and NPDWRs for contaminants that may have an adverse effect on the health of persons and may occur in systems at a frequency and level of public concern and for which, in the sole judgment of the Administrator, regulation of the contaminant would present a meaningful opportunity for health risk reduction for persons served by PWSs (SDWA Section 1412(b)(1)(A)). The 1986 amendments to the SDWA established a list of 83 contaminants for which the EPA is to develop MCLGs and NPDWRs, which included lead and copper. The 1991 NPDWR for lead and copper (56 FR 26460; USEPA, 1991) fulfilled the requirements of the 1986 SDWA amendments with respect to lead and copper.

The EPA is finalizing revisions to the lead and copper regulations under the authority of the following sections of the SDWA: 1412, 1413, 1414, 1417, 1445, and 1450 (42 U.S.C. §§ 300f et seq.).

Section 1412(b)(7)(A) of the SDWA authorizes the EPA to promulgate a treatment technique "which in the Administrator's judgement, would prevent known or anticipated adverse effects on the health of persons to the extent feasible." (42 U.S.C. § 300g-1(b)(7)(A)). Section 1412(b)(9) provides that "[T]he Administrator shall, not less often than every 6 years, review and revise, as appropriate, each national primary drinking water regulation promulgated under this subchapter. Any revision of a national primary drinking water regulation shall be promulgated in accordance with this section, except that each revision shall maintain, or provide for greater, protection of the health of persons." (42 U.S.C. § 300g-1(b)(9)). In finalizing a revised NPDWR, the EPA follows the applicable procedures and requirements described in Section 1412, including those related to 1) the use of the best available, peer-reviewed science and supporting studies; 2) presentation of information on public health effects; and 3) a health risk reduction and cost analysis of the rule (42 U.S.C. § 300g-1(b)(3)(A)-(C)).

Section 1413(a)(1) of the SDWA allows the EPA to grant a State primary enforcement responsibility ("primacy") for NPDWRs when the EPA has determined that the State has adopted regulations that are no less stringent than the EPA's regulations (42 U.S.C. § 300g-2(a)(1)). To obtain primacy for this rule, States must adopt comparable regulations within two years of the EPA's promulgation of the final rule, unless the EPA grants the State a two-year extension. State primacy requires, among other things, adequate enforcement (including monitoring and inspections) and reporting. The EPA must approve or deny State primacy applications within 90 days of submission to the EPA (42 U.S.C. § 300g-2(b)(2)). In some cases, a State submitting revisions to adopt an NPDWR has primary enforcement authority for the new regulation while the EPA's decision on the revision is pending (42 U.S.C. § 300g-2(c)).

Section 1414(c) of the SDWA, as amended by the WIIN Act, requires PWSs to provide notice to the public if the water system exceeds the lead AL (42 U.S.C. § 300g-3(c)). Section 1414(c)(2) provides that the Administrator "shall, by regulation … prescribe the manner, frequency, form, and content for giving notice" (42 U.S.C. § 300g-3(c)(2)). Section 1414(c)(2)(C) specifies additional requirements for those regulations related to public notification of a lead ALE "that has the potential to have serious adverse effects on human health as a result of short-term exposure," including requirements for providing notification to the EPA.

Section 1417(a)(2) of the SDWA provides that PWSs "shall identify and provide notice to persons that may be affected by lead contamination of their drinking water where such contamination results from the lead content of the construction materials of the public water distribution system and/or corrosivity of the water supply sufficient to cause leaching of lead" (42 U.S.C. § 300g-6(a)(2)(A)(i) and (ii)). The notice "shall be provided notwithstanding the absence of a violation of any national drinking water standard" (42 U.S.C. § 300g-6(a)(2)(A)).

Section 1445(a) of the SDWA authorizes the Administrator to establish monitoring, recordkeeping, and reporting regulations, to assist the Administrator in establishing regulations under the SDWA, determining compliance with the SDWA, and in advising the public of the risks of unregulated contaminants (42 U.S.C. § 300j-4(a)). In requiring a PWS to monitor under Section 1445(a), the Administrator may take into consideration the water system size and the contaminants likely to be found in the system's drinking water (42 U.S.C. § 300j-4(a)). Section 1445(a)(1)(C) of the SDWA provides that "every person who is subject to a national primary drinking water regulation" must provide such information as the Administrator may reasonably require to assist the Administrator in establishing regulations under Section 1412 (42 U.S.C § 300j-4(a)(1)(C)).

Section 1450 of the SDWA authorizes the Administrator to prescribe such regulations as are necessary or appropriate to carry out his or her functions under the Act (42 U.S.C § 300j-9).

2.6 Economic Rationale

This section addresses the economic rationale, as described in Executive Order 12866, *Regulatory Planning and Review* (58 FR 51735, October 4, 1993), for choosing a regulatory approach to regulate lead and copper levels in drinking water supplies rather than nonregulatory alternatives. Executive Order 12866 states the following:

> [E]ach agency shall identify the problem that it intends to address (including, where applicable, the failures of the private markets or public institutions that warrant new agency action) as well as assess the significance of that problem (Section 1, b(1)).

In addition, OMB Circular A-4, dated September 17, 2003, states that:

> "… [the analyst] should try to explain whether the action is intended to address a significant market failure or to meet some other compelling public need such as improving governmental processes or promoting intangible values such as distributional fairness or privacy" (USOMB, 2003).

In the case of the final LCRI, several properties of public water suppliers do not satisfy the conditions for a perfectly competitive market and thus lead to market failures that require regulation. In a perfectly

competitive market, prices and quantities are determined solely by the aggregated decisions of buyers and sellers. Such a market occurs when many producers of a product are selling to many buyers, and where both producers and consumers have perfect information on the characteristics and prices of each firm's products. Barriers to entry in the industry cannot exist, and individual buyers and sellers must be "price takers" *(i.e.*, their individual decisions cannot affect the price).

Many water systems are natural monopolies. A natural monopoly exists when the most efficient number of firms is one due to high fixed costs, economies of scale and barriers to entry. For PWSs, there are high fixed costs associated with reservoirs and wells, transmission and distribution systems, treatment plants, and other facilities. For other potential suppliers to enter the market, they would need to provide the same extensive infrastructure to realize similar economies of scale and be competitive. A splitting of the market with increased fixed costs (*e.g.*, two supplier networks in a single market) usually makes this situation unprofitable. The result is a market suitable for a single supplier and hostile to additional suppliers. In such natural monopolies, the monopoly will charge a price that exceeds the marginal cost, earning monopoly profits. The monopolistic firm faces fewer incentives to provide quality services than if operating in a competitive market. In the case of the drinking water market a problem with asymmetric/incomplete information also exists where drinking water systems are not incentivized to provide high quality water to consumers because the customers know very little about the quality of the water they are purchasing. In these situations, governments often intervene to help protect the public interest by setting rates and ensuring the quality of the good or service. Consumers may purchase bottled water, but this option can be much more expensive per unit than tap water of similar quality. Consumers may also install and operate home treatment systems, but this can also be considerably more expensive because they do not have the economies of scale of large, centralized water systems and home treatment systems potentially can lead to increased health risks when not regularly maintained by the consumer.

The public may not understand the health and safety issues associated with poor drinking water quality, resulting in the existence of inadequate or asymmetric information. Understanding the health risks posed by trace quantities of drinking water contaminants involves analysis and synthesis of complex toxicological and health sciences data. Therefore, the public may not be aware of the risks it faces and therefore may not advocated for improved water quality. Monopolistic drinking water systems and oversite bodies may be slower to react to water quality issues without an informed public advocating for improvements. The EPA has implemented a Consumer Confidence Report (CCR) Rule (63 FR 44512; USEPA, 1998) that makes water quality information more easily available to consumers. In addition, the EPA promulgated revisions to this regulation on May 24, 2024 (89 FR 45980; USEPA, 2024b) in accordance with America's Water Infrastructure Act (AWIA) of 2018 (United States, 2018) and to require reporting of compliance monitoring data to the EPA. The revisions to the CCR improve the readability, clarity, and understandability of CCRs as well as the accuracy of the information presented, improve risk communication in CCRs, incorporate electronic delivery options, and provide supplemental information regarding lead levels and control efforts. This rule requires CWSs that serve 10,000 or more people to provide CCRs to customers biannually (twice per year) as opposed to annually. Consumers, however, still need to analyze this information for its health risk implications. Furthermore, even if informed consumers can engage systems in a dialogue about health issues, the transaction costs of such interaction (measured in personal time and monetary outlays) present another significant impediment to consumer expression of risk reduction preferences.

Several of the rule changes under the final LCRI specifically compensate for inadequate or asymmetric information. For example, the final LCRI greatly expands the PE and outreach requirements to provide consumer notice to individuals who participated in the compliance sampling pool with their lead and copper test results as soon as practicable but no later than three business days, and educational materials to those served by service lines with known or possible lead content, and those potentially impacted by disturbances to a known or potential service line containing lead. The requirements also extend beyond the customer base to provide State and local health agencies with PE materials and require greater public accessibility to information on lead-related information, such as LSL locations and lead tap sample results. The more robust PE will provide consumers will more timely and useful information to make more informed decisions and subsequently reduce their exposure to lead.

Overall, the SDWA regulations are intended to provide health protection from exposure to drinking water contaminants. The regulations set minimum safety standards to protect consumers from exposure to contaminants in drinking water supplies. The SDWA regulations are not intended to restructure market mechanisms or establish competition in supply; rather, they establish the level of service to be provided that best reflects public preference for safety. Federal regulations reduce the high information and transaction costs by acting on behalf of consumers in balancing risk reduction and the social costs of achieving this risk reduction.

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3 Baseline Drinking Water System Characteristics

3.1 Introduction

In its *Guidelines for Preparing Economic Analyses*, the United States Environmental Protection Agency (EPA, or USEPA) characterizes the "baseline" as a reference point that reflects the world without the final regulation (USEPA, 2014). It is the starting point for estimating the potential benefits and costs. This chapter presents a characterization of public water systems (PWSs) and their current operations (*i.e.,* the baseline) before changes are made to meet the regulatory requirements for the 2021 Lead and Copper Rule Revisions (LCRR) or the final Lead and Copper Rule Improvements (LCRI). Section 3.2 identifies each major source used to develop the baseline. Section 3.3 explains the derivation of each baseline characteristic and presents results in detailed tables. Section 3.4 summarizes limitations of the major data sources and uncertainties in the baseline characterization (both quantified and unquantified) in tabular format.

Note that the EPA uses the SafeWater Lead and Copper Rule (LCR) model to estimate national costs of the 2021 LCRR and the final LCRI. The estimated national cost of the 2021 LCRR are then subtracted from the final LCRI cost estimates to compute the incremental estimated cost of the final LCRI. See Chapter 4, section 4.2 for an in-depth discussion of the SafeWater LCR model. See Appendix B, Sections B.5 and B.6 for a discussion of the data variables and the estimated burden and costs associated with the implementation of the 2021 LCRR. Also, review the Chapter 4, Sections 4.3 and 4.4 data variable descriptions and estimated burden and costs for the final LCRI.

3.2 Data Sources

The EPA used a variety of data sources to develop the baseline. Additional background on each of these data sources is provided in the following subsections:

- **Section 3.2.1** explains the relevant information provided in the federal version of the Safe Drinking Water Information System (SDWIS/Fed) and measures the EPA has taken to verify the data.
- **Section 3.2.2** explains the purpose of the 2006 Community Water System Survey (CWSS) and the representativeness of the data.
- **Section 3.2.3** explains the relevant information that was used from the third Unregulated Contaminant Monitoring Rule (UCMR 3).
- **Section 3.2.4** describes a key information source used to characterize corrosion control treatment (CCT) costs.
- **Section 3.2.5** describes the 7th Drinking Water Infrastructure Needs Survey and Assessment (DWINSA) data that were used to develop the EPA's characterization of service line material, identify individual systems with lead content service lines, and estimate service line replacement costs.

- **Section 3.2.6** provides an overview of the system compliance monitoring data voluntarily submitted to the EPA by States from 2006 to 2011, data cleaning steps, and data representativeness.
- **Section 3.2.7** describes the State of Michigan lead tap monitoring dataset that included first- and fifth-liter compliance monitoring samples collected in 2019, 2020, and 2021, as well as data cleaning steps.
- **Section 3.2.8** describes other information sources used to characterize a subset of the population served by CWSs that provide services to sensitive subpopulations (*i.e.*, infants, children, and pregnant women). Note that the EPA used several studies to characterize sensitive subpopulations affected by the rule. These studies are discussed in Chapter 5.

Exhibit 3-1 identifies each major data source detailed in Sections 3.2.1 through 3.2.7 and the baseline data element(s) derived from them. Data sources used for pre-2021 LCR and 2021 LCRR are provided in Appendix B.

Exhibit 3-1: Data Sources Used to Develop the Baseline for the Final LCRI

Data Source	Baseline Data Derived from the Source
SDWIS/Fed fourth quarter 2020 "frozen" dataset[1]	• PWS inventory, including population served, number of service connections, source water type, and water system type. Also used to identify NTNCWSs that are schools and child care facilities. • Status of CCT, including identification of water systems with CCT and the proportion of water systems serving ≤ 50,000 people that installed CCT in response to the pre-2021 LCR. • Analysis of lead 90th percentile concentrations to identify water systems below, at, or above the lead and/or copper ALs at the start of rule implementation by LSL status, i.e., presence or absence of LSLs for the pre-2021 LCR, 2021 LCRR, and final LCRI. Used in concert with data from Michigan described below for the final LCRI.[2] • The proportion of water systems that are on various reduced monitoring schedules for lead tap and WQP monitoring. • The frequency of source and treatment changes and those source changes that can result in additional source water monitoring. • Number of distribution system entry points per drinking water system for systems that were not included in the UCMR 3 dataset.
2006 CWSS (USEPA, 2009)	• PWS labor rates.
UCMR 3 (2013-2015)	• Number of distribution system entry points per drinking water system.
7th DWINSA and Supplemental One-time Update	• Service line material characterization. • Service line replacement costs.
State service line information	• Service line material characterization.
Geometries and Characteristics of Public Water Systems (USEPA, 2000)	• Design and average daily flow per system.

Data Source	Baseline Data Derived from the Source
Six-Year Review 3 ICR Occurrence Dataset (2006-2011)	• Baseline distribution of pH for various CCT conditions. • Baseline orthophosphate dose for CCT.
State of Michigan Lead and Copper Compliance Monitoring Data (Michigan EGLE, 2019-2021)	• Analysis of the ratio of fifth- to first-liter lead tap samples to estimate the increase in lead 90th percentile levels for LSL systems based on the use of the higher of the first- or fifth-liter sample result. Ratios are applied to SDWIS/Fed lead 90th percentile data to identify systems below, at, or above the AL under the final LCRI by LSL status. • Percent of individual samples exceeding 0.010 mg/L for the final LCRI.

Acronyms: AL = action level; CCT = corrosion control treatment; CWSS = Community Water System Survey; DWINSA = Drinking Water Infrastructure Needs Survey and Assessment; ICR = Information Collection Request; LCR = Lead and Copper Rule; LCRR = Lead and Copper Rule Revisions; LCRI = Lead and Copper Rule Improvements; LSL = lead service line; Michigan EGLE = Michigan Department of Environment, Great Lakes, and Energy; NTNCWS = non-transient non-community water system; public water system; SDWIS/Fed = Safe Drinking Water Information System/Federal version; UCMR 3 = Third Unregulated Contaminant Monitoring Rule; USEPA = United States Environmental Protection Agency; WQP = water quality parameter.

Note:

[1] Contains information reported through December 31, 2020.

[2] A system's lead 90th percentile level is a key factor in determining a system's requirements under the pre-2021 LCR, 2021 LCRR, and final LCRI.

3.2.1 SDWIS/Fed 2020

SDWIS/Fed is the EPA's national regulatory compliance database for the drinking water program. It contains water system inventory, 90th percentile lead and copper levels, treatment facility information, violation, and enforcement information for PWSs as reported by States, the EPA Regions, and the EPA Headquarters personnel. States report data quarterly to the EPA. The information presented in the economic analysis (EA) is based on the fourth quarter 2020 "frozen" dataset that contains information reported through December 31, 2020.[15]

SDWIS/Fed contains information to characterize the United States inventory of PWSs, namely: system name and location; retail population served; source water type (*i.e.*, ground water (GW), surface water (SW), or ground water under the direct influence of surface water (GWUDI)); and PWS type, as described in Section 3.2.1.1. SDWIS/Fed also includes 90th percentile lead and copper levels, milestones, violations, and enforcement actions, as detailed in Section 3.2.1.2. A description of the treatment facility information in SDWIS/Fed is in Section 3.2.1.3. Section 3.2.1.4 summarizes steps by the EPA to verify SDWIS/Fed information.

3.2.1.1 Classification of Systems Using SDWIS/Fed Data

This section describes how the EPA classified systems by type (Section 3.2.1.1.1), population served (Section 3.2.1.1.2, and source water (Section 3.2.1.1.3) using data from SDWIS/Fed.

3.2.1.1.1 System Type

The Safe Drinking Water Act (SDWA) defines a system as one that provides water for human consumption through pipes or other constructed conveyances to at least 15 service connections or

[15] This dataset represented the most current full year of data at the time the EPA started the proposed LCRI EA.

regularly serves an average of at least 25 individuals per day for at least 60 days per year. Systems are categorized as follows:

- Community water systems (CWSs) are systems that supply water to the same population year-round.
- Non-community water systems (NCWSs) are systems that supply water to a varying population or one that is served less than year-round. They are sub-categorized as follows:
    - Non-transient non-community water systems (NTNCWSs) are systems that are not CWSs and that regularly supply water to at least 25 of the same people at least six months per year, for example, schools.
    - Transient non-community water systems (TNCWSs) are NCWSs that provide water in places such as gas stations or seasonal campgrounds where people do not remain for long periods of time.

The final LCRI would not apply to TNCWSs. Therefore, system inventories in this EA are classified into two categories, CWSs and NTNCWSs.

3.2.1.1.2 Population Served

Systems are also categorized by the number of people they serve.[16] The following nine categories of populations served by systems are used throughout this EA:

- ≤ 100
- 101–500
- 501–1,000
- 1,001–3,300
- 3,301–10,000
- 10,001–50,000
- 50,001–100,000
- 100,001–1,000,000 (1M)
- > 1M

The EPA has developed these system size categories based on distinctions in the way systems operate as the amount of water supplied and number of service connections increases. Systems within each size category can be expected to face similar implementation and cost challenges when complying with the regulatory requirements for the final LCRI.

[16] SDWIS/Fed classifies systems according to “retail” population that does not include the population served by other systems that purchase water from them.

3.2.1.1.3 Source Water Type

SDWIS/Fed classifies systems by source water using the following six categories:

1. GW
2. GW purchased
3. GWUDI[17]
4. GWUDI purchased
5. SW
6. SW purchased

For this final LCRI analysis, the EPA broadly categorized systems as SW if any of their sources were SW, SW purchased, GWUDI, or purchased GWUDI. Source water type is important in estimating treatment costs for the rule due to the fact that GW systems typically have more entry points and thus, more treatment and water quality parameter (WQP) monitoring locations, than SW systems. Systems were classified as GW if they exclusively used GW or purchased GW. See Section 3.3.1 for the EPA's approach for assigning a source type to the small number of CWSs and NTNCWSs without a reported source water type to develop the system inventory for this EA.

3.2.1.2 Lead and Copper Rule-Specific Data

This section describes specific data that States must report to the EPA using SDWIS/Fed under the pre-2021 LCR and reflects the requirements prior to the implementation of the final LCRI. It is organized into the following subsections:

- 3.2.1.2.1: 90th Percentile Levels
- 3.2.1.2.2: Violations/Compliance Achieved
- 3.2.1.2.3: Milestones.

3.2.1.2.1 90th Percentile Levels

Under the pre-2021 LCR, systems are required to report all lead and copper tap sample results used to calculate their lead and copper 90th percentile levels to their State. States are required to report to SDWIS/Fed all lead 90th percentile values in mg/L for systems serving more than 3,300 people[18] and 90th percentile values in mg/L above the action level (AL) of 0.015 mg/L[19] for systems serving 3,300 or fewer.

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[17] 40 CFR section 141.2 defines GWUDI as "any water beneath the surface of the ground with significant occurrence of insects or other macro-organisms, algae, or large-diameter pathogens such as *Giardia lamblia* or *Cryptosporidium,* or significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions."

[18] Prior to 2002, States were not required to report lead 90th percentile levels that were at or below the lead AL for systems serving 3,300 or fewer people.

[19] As discussed throughout the economic analysis, the AL under the final LCRI has been lowered to 0.010 mg/L.

For all systems, States are also required to report to SDWIS/Fed copper 90th percentile levels above the AL of 1.3 mg/L.

Under the pre-2021 LCR, a system has an action level exceedance (ALE) if more than 10 percent of tap water samples collected during any monitoring period are found to be greater than 0.015 mg/L for lead or 1.3 mg/L for copper (*i.e.*, if the 90th percentile level is greater than the AL). An ALE is not a violation but triggers additional actions. These actions include CCT steps, WQP monitoring, source water monitoring and source water treatment, if needed. A lead ALE also triggers lead service line replacement (LSLR) for systems with treatment in place for lead and public education for all systems with a lead ALE.

3.2.1.2.2 Violations/Compliance Achieved

Systems are in violation of the pre-2021 LCR if they do not meet the treatment technique requirements related to LSLR, CCT, source water treatment, public education (PE), or monitoring and reporting requirements. States are required to report to SDWIS/Fed, systems that are in violation of these requirements using specific codes that identify the type of violation and the action taken by the system or State to address these violations. As explained in Section 3.3.3, the EPA used the following subset of violations to estimate the number of systems with CCT[20]:

- **Violation code 58** denotes systems that failed to meet their CCT requirements. This includes failure to properly install or operate State-approved CCT, submit a certification that CCT is being properly installed and operated, or to demonstrate that optimal corrosion control treatment (OCCT) already exists in accordance with 40 CFR 141.81(b)(1)-(3) and 141.90(c)(1).[21]
- **Violation code 59** denotes systems that fail to meet the optimal water quality parameter (OWQP) values set by the State. OWQPs are set by the State after a system has collected WQP samples during two consecutive, six-month monitoring periods, following the installation of CCT. OWQPs are measured to determine whether a system is operating its CCT at a level that most effectively minimizes the lead and copper concentrations at users' taps.

States are also required to report enforcement actions taken by the State or the EPA in response to a violation, and to report when a system has achieved compliance. As discussed in Section 3.3.3, the EPA enforcement action code for compliance achieved is "SOX" or "EOX." Systems that have returned to compliance with a type 58 violation are likely to have installed CCT.

See "Safe Drinking Water Information System Federal (SDWIS Fed) Data Reporting Requirements" for additional information on SDWIS/Fed reporting requirements (USEPA, 2016a).

3.2.1.2.3 Milestones

States report milestone information to indicate the initiation or completion of key requirements under the pre-2021 LCR. The EPA used the following milestones data to characterize the baseline. Specifically, the EPA used the "Deem" and "Done" milestones to help estimate the number of systems with CCT (see

[20] Each violation has a specific code. A violation is reported in SDWIS/Fed using the specific violation code (e.g., 58 or 59) vs. Y or N. States do not report if the system has no violation, only if there is a violation.
[21] Code 58 is also used to identify water systems that are in violation of the source water treatment installation requirements. However, very few water systems have high lead and/or copper source water levels and are required to install source water treatment.

Section 3.3.3) and LSLR milestone to estimate the average number of years a system is required to replace lead service lines (LSLs) under the pre-2021 LCR.

- "**Deem"** represents the basis for the State's determination that a system is "deemed" to be optimized under the LCR. Systems with a reason code of "WQP" have installed CCT.
- **"Done"** indicates when a water system has completed all required steps to reduce lead and/or copper levels. Systems with a reason code of "WQP" have installed CCT.
- **"LSLR"** indicates water systems that are required to initiate LSLR; States are also required to report when this replacement is scheduled to begin.

3.2.1.3 Treatment Facility Information

States report treatment information to SDWIS/Fed for each system's drinking water treatment facilities. Specifically, for each treatment plant, States report 1) the treatment objective codes from a list of 13 available options and 2) treatment process codes from a list of 71 available options. For example, the treatment objective code of "C" denotes corrosion control and the treatment process code of 445 indicates orthophosphate inhibitor. States can report multiple treatment objective codes for each plant, and multiple treatment process codes for each plant or for each objective code.

The EPA uses treatment code information to help determine the percent of systems with CCT and which type of CCT they have in place (pH adjustment, orthophosphate, or both) as described in Section 3.3.3 and Section 4.3.3 in Chapter 4, respectively. The EPA also uses treatment information from SDWIS/Fed to evaluate changes in treatment over time to predict the percent of systems that would change treatment each year, as described in Section 3.3.9.

3.2.1.4 Verification of SDWIS/Fed Data

The EPA routinely conducts Program Reviews to verify whether information in the States' databases and files, such as inventory, 90th percentile data, and violations for all regulations are correctly represented in SDWIS/Fed. Between 2006 and 2016, the EPA recorded the findings from these reviews in the national Error Code Tracking Tool (ECTT) (USEPA, 2007).[22] The ECTT contains, as individual records, all actions assessed during each Program Review. The EPA identifies records as confirmed actions (correct compliance determinations and correct reporting to SDWIS/Fed), compliance determination discrepancies (incorrect compliance determinations), or data flow discrepancies (correct compliance determination but incorrect reporting). This section presents data from the ECTT from Program Reviews conducted from 2006 to 2016 related to water system inventory (Section 3.2.1.4.1) and LCR compliance data (Section 3.2.1.4.2).

It is important to note that treatment data (objective codes and process codes for plants in SDWIS/Fed) are not evaluated during Program Reviews and therefore have more uncertainty associated with the data as compared to water system inventory and compliance data.

[22] More recent data were not available for use in this analysis as the EPA no longer used the ECTT after 2016.

3.2.1.4.1 Water System Inventory

From 2006 to 2016, the EPA evaluated water system inventory data for a total of 2,180 systems. Prior to August 2007, the Program Reviews evaluated eight water system inventory fields: system type, system status, activity status, source type, population, service connection, administrative contact, and administrative address. Afterwards, the reviews did not include administrative contact or address. In addition, in August 2007, the review policy changed so that discrepancies for water system inventory were only identified if they affected monitoring requirements (*e.g.*, change in population that would increase or decrease the minimum number of required samples).

Of the water system inventory fields evaluated from 2006 to 2016, only 82 (<1 percent) inventory discrepancies were identified. Some of these discrepancies could be for things that do not impact the PWS baseline characterization such as administrative contact and address. The water system inventory data in ECTT indicate a high degree of completeness and accuracy in SDWIS/Fed.

3.2.1.4.2 LCR Compliance Monitoring Data

To assess the completeness and accuracy of the SDWIS/Fed LCR compliance monitoring data, which is reported to the State as the 90th percentile of tap monitoring results, the EPA determined whether States had reported the following:

- The correct 90th percentile levels to SDWIS/Fed by comparing it to the computed 90th percentile levels from the individual monitoring results submitted by systems.[23]
- All required 90th percentile levels.

File reviews conducted between 2006 and 2016 evaluated 2,180 systems for two rounds of lead sampling and evaluated 4,360 rounds of lead samples for 53 primacy agencies. Of these data, the 90th percentile level sample values were properly calculated and reported to SDWIS/State for 4,212 (87 percent) of the sample rounds. The file review also evaluated whether the samples were properly collected, including a sufficient number of samples, correct sampling procedure, collection during the correct monitoring period. The review determined that systems complied with these additional requirements for 87 percent of the sample rounds. The file reviews also determined that systems failed to take the required steps after a lead ALE, including PE, CCT study (when required), WQP sampling, or follow-up monitoring after installation of CCT in some instances.

3.2.2 2006 Community Water System Survey

The EPA periodically conducts the CWSS to obtain data to support the agency's development and evaluation of drinking water regulations. The 2006 CWSS is the most recent survey (USEPA, 2009). For this EA, the EPA used the 2006 CWSS to develop hourly labor rates by system size (see Section 3.3.11.1). These rates are multiplied by the burden estimates in the SafeWater LCR cost model to develop labor cost for water systems to comply with the requirements of the final LCRI. See Chapter 4 for additional detail pertaining to the final LCRI and Appendix B for information related to the pre-2021 LCR and 2021 LCRR.

[23] This evaluation also assessed whether the 90th percentile level was reported for the correct monitoring period.

3.2.3 Unregulated Contaminant Monitoring Rule 3

The EPA uses the UCMR to collect nationally representative data for contaminants that are suspected to be present in drinking water and do not have health-based standards set under SDWA. Monitoring under the third round of UCMR (UCMR 3) was conducted from 2013 through 2015.[24] Similar in design to the first two rounds of UCMR sampling (UCMR 1 and UCMR 2), UCMR 3 required SW systems to monitor quarterly and GW systems to monitor semi-annually to capture seasonal variability. For UCMR 3, all large and very large PWSs (serving between 10,001 and 100,000 people and serving more than 100,000 people, respectively), plus a statistically representative national sample of 800 small PWSs (serving 10,000 people or fewer), were required to conduct Assessment Monitoring during a 12-month period between January 2013 and December 2015. For all UCMR 3 contaminants, systems were required to gather samples at the entry point to the distribution system. As described in Section 3.3.6.1, the EPA developed estimates of entry points per system using unique sampling point data from UCMR 3.

3.2.4 Geometries and Characteristics of Public Water Systems (2000)

An important factor in determining costs of CCT is average daily flow and design flow, in gallons per day or million gallons per day, at a treatment plant. The EPA estimated the average daily flow and design flow for each entry point in the system based on the relationship between retail population and flow as derived in the document, *Geometries and Characteristics of Public Water Systems* (USEPA, 2000).[25]

Utilizing data from the 1995 CWSS, the EPA conducted an extensive data cleaning process[26] to develop a dataset consisting of 1,734 records with paired responses for population and total average daily flow. These data were then weighted to account for non-responses to individual questions from the CWSS. This dataset was used to develop regression equations that predict average daily flow based on retail population served (for both publicly-owned and privately-owned systems). The data show a very good correlation as indicated by a high R value of 0.90. Additional information and background data are provided in Chapter 4 of the *Geometries and Characteristics of Public Water Systems* (USEPA, 2000) and in Section B1.4.2 of the *Drinking Water Baseline Handbook, Fourth Edition* (USEPA, 2003). Note that household water use has generally declined over the period since this analysis was completed and therefore the EPA's estimated national costs for CCT are likely overestimated. For additional information see Section 3.4.

3.2.5 7th Drinking Water Infrastructure Needs Survey and Assessment (DWINSA)

Every four years, the EPA works with States and CWSs to conduct the Drinking Water Infrastructure Needs Survey and Assessment (DWINSA) to estimate the Drinking Water State Revolving Fund (DWSRF)-eligible needs of systems by State. Through this survey, systems submit DWSRF-eligible infrastructure projects that are necessary over the next 20 years to continue to provide safe drinking water to the public. These projects include infrastructure needs that are eligible for, but not necessarily financed by,

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[24] See USEPA (2012a) and USEPA (2019) for more information on the UCMR 3 study design and data analysis, including a complete list of analytes.

[25] The analysis was republished in the *Drinking Water Baseline Handbook*, Fourth Edition (USEPA, 2003).

[26] EPA adjusted the dataset to remove non-zero values; adjusted flow if needed to represent retail flow only removing wholesale water flow; and adjusted for reporting discrepancies in population, flow, or service connections.

the DWSRF, including the installation of new drinking water infrastructure and the rehabilitation, expansion, or replacement of existing infrastructure.

The EPA's 7th DWINSA consisted of a survey of all systems in the country serving more than 100,000 people, a per-State sample of systems serving between 3,301 and 100,000 people, and a national sample of systems serving 3,300 or fewer people (USEPA, 2023a).[27] The surveyed systems for the 7th DWINSA included CWSs and not-for-profit non-community water systems (NPNCWS) in States, U.S. Territories, and American Indian (AI) and Alaska Native Village (ANV) water systems. The assessment selected a stratified random sample of systems, dividing systems into mutually exclusive categories based on the systems' water source and the number of people served.[28] The EPA administered the 7th DWINSA to a total of 3,629 water systems and received 3,526 responses. This large number of participants and 97 percent response rate provides a high degree of confidence in the statistical precision of the assessment's findings.

As part of the 7th DWINSA, the EPA collected service line material information for the first time in 2021. The same 3,629 water systems participating in the primary DWINSA were surveyed using the 7th DWINSA service line questionnaire, which collected information on the number of service lines by material type. The service line questionnaire was optional; however, approximately 80 percent of water systems provided complete responses about their service lines.[29] This dataset included CWSs from all States plus D.C., Puerto Rico, Guam, American Samoa, the Northern Mariana Islands, and the U.S. Virgin Islands. In this questionnaire form, systems were also asked to group their service line inventory into eight categories: lead pipe, lead connectors, galvanized service lines downstream from a lead pipe, galvanized service lines downstream from a lead connector, galvanized service lines downstream from an unknown lead source, standalone galvanized service lines, or non-lead/non-galvanized service lines.[30] The inventories of systems that did not respond to the written survey were classified as "unreported."

[27] The 7th DWINSA used the list of systems from the second quarter of 2019 freeze of SDWIS/Fed. It used the retail and consecutive population to determine each system's population. This population was reviewed by the states and revised when necessary. The final population of each system in the survey is based on the systems' survey responses.

[28] The 7th DWINSA used a sample of water systems to estimate total infrastructure needs and the number of lead service lines in each state and in the nation. Within each State, water systems were divided into several categories based on each system's water source and the size of the population served. The 7th DWINSA included all systems serving more than 100,000 people and a random sample of systems serving between 3,301-100,000 people from each category of systems in each State, as well as a random sample of systems serving 3,000 of fewer people from each category of systems nationally. The number of systems in each State and each system's population are based on information in SDWIS/Fed as of the second quarter of 2019, as reviewed and revised by the States. To estimate state totals for medium and large systems using the sample, each system was assigned a weight equal to the number of systems in the category divided by the number of systems sampled from that category. For example, if the survey included a sample of three systems from a category that consists of 12 systems, each of the three systems from that category would receive a weight of 4 (12 ÷ 3 = 4). The final sampling weights are adjusted to account for non-response.

[29] A modified version of the survey was provided to American Indian and Alaska Native Village CWSs, but the responses were not included in the totals.

[30] Note survey information does not provide specific detail on service line lengths being replaced. EPA cost estimates assume the distribution of DWINSA data line lengths is equal to the national distribution. Note although length of service line being replaced is positively correlated with cost, the larger cost drivers in SLR are associated with

In August 2023, the EPA initiated a one-time effort to update the LSL counts from the 7th DWINSA (USEPA, 2024a; 2024b). This update allowed previously surveyed water systems and States to revise their original response based on new service line inventory information or to provide responses if they had not participated earlier. Participation in this update, which was limited to the service line material questionnaire, was voluntary.

Through this effort, the EPA surveyed 2,888 medium and large systems 50 States, the District of Columbia, Puerto Rico and four territories, receiving 2,089 responses (a 72% response rate): 596 reporting updates and 1,493 indicating no changes. Additionally, the EPA surveyed 695 small systems, receiving 132 responses (a 19% response rate): 64 reporting updates and 68 indicating no changes. Note the low response rate by small systems to the one-time update is related to the use of trained site visitors to assist in the collection of the small system data during the original survey. The EPA gave small systems the opportunity to participate in the one-time update but did not expect many responses because the site visitors provided the original data. Some systems took advantage of the opportunity and provided updates, but most of the original data were accurate because site visitors assisted in the collection of the data. The EPA then combined the data from the initial survey and the August 2023 update by both adding new respondent data from the update survey to the 7th DWINSA dataset and by replacing the original 7th DWINSA information with new data when respondents updated information as part of the August 2023 effort. Note that the sample weights were not recalculated, as the sample of water systems for both the one-time update and the 7th DWINSA were identical.

The EPA used the results of the 7th DWINSA as cost model inputs to the LCRI EA as follows:

- To characterize service line material. The EPA used the combined results of the original 7th DWINSA and the one-time update to develop the service line characterization. For details on the methodology and results, see Section 3.3.4.
- To identify systems with known LSL status. For the purpose of analyzing 90th percentile lead levels for systems with known LSLs and all non-lead service lines as described in Section 3.3.5.
- To estimate unit costs of LSLR. The EPA reviewed LSL project costs submitted and accepted by the 7th DWINSA and prepared a distribution of unit costs for full and partial replacements. Appendix A provides a discussion of the methods the EPA used to select LSLR projects and the final estimated replacement cost results.

3.2.6 Six-Year Review Data

The EPA used information from the third Six-Year Review Information Collection Request (ICR) Dataset (hereafter referred to as the "SYR3 ICR dataset") to characterize the pH of finished water and the distribution of orthophosphate dose. The SYR3 ICR dataset contains more than 47 million records of water system compliance monitoring data for chemical, microbial, disinfection byproduct, and radionuclides collected from 2006 through 2011. The SYR3 ICR dataset and general quality assurance/quality control (QA/QC) procedures are further described in USEPA (2016b) and USEPA (2016c).

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the mobilization of crews, the method of replacement, depth of pipe, and the amount of restoration (concrete and road repair) work required.

Forty-four States, D.C., American Samoa, and five EPA Regions submitted individual compliance monitoring sample result for lead as part of the SYR3 ICR data set.[31] A number of QA steps were applied to the SYR3 ICR dataset to identify water quality data on system pH and orthophosphate concentration records suitable for analyses. Data were excluded via the following QA steps:

- Records from non-public water systems.
- Records marked as not being for compliance.
- Records marked with a sample type code equal to something other than "RT" (routine) or "CO" (confirmation). For example, "RP" for "repeat" or "SP" for "special."
- Records from outside of the SYR3 date range of 2006 – 2011.
- Records from systems that were missing water system inventory information such as the system's population served or source water type.

3.2.7 State of Michigan Lead Compliance Monitoring Data

The EPA evaluated lead and copper compliance monitoring data provided by the State of Michigan, Department of Environment, Great Lakes, and Energy (EGLE) for January 1, 2019, through December 31, 2021. Michigan's State-level lead and copper regulations require systems to collect a first- and fifth-liter sample at sites with an LSL (any portion of the service line containing lead) and to collect a first liter sample only for all other sites (service lines made of galvanized, copper, or plastic pipe). Based on Michigan's requirements, the EPA identified systems collecting both a first- and fifth-liter sample as a system with LSLs and those collecting only a first-liter as a system without LSLs. SDWIS/Fed does not indicate the LSL status of water systems (*i.e.*, the presence or absence of LSLs). Thus, the EPA used the subset of CWSs in Michigan with LSLs to adjust the 90th percentile value reported to SDWIS/Fed for non-Michigan systems that the EPA identified as having LSLs (see 3.3.5.1.1 for EPA's approach for identifying systems with LSLs). The EPA was then able to categorize these systems by LSL status into one of five lead 90th percentile classifications under the pre-2021 LCR and the 2021 LCRR (see Appendix B), and the final LCRI (see Section 3.3.5.1).[32] Thus, the EPA used the subset of CWSs in Michigan with known LSL status and 90th percentile data reported to estimate the national percentage of systems by LSL status that would be categorized into one of five lead 90th percentile classifications under the pre-2021 LCR, the 2021 LCRR, and the final LCRI (see Section 3.3.5.1). The EPA also used the Michigan date to estimate the likelihood a single sample would exceed 0.015 mg/L under the 2021 LCRR (see Appendix B) and 0.010 mg/L under the final LCRI (see Section 3.3.5.3). The EPA recognizes the uncertainty introduced in using data from a single State that may not represent the values on a national level. The Michigan data on first- and fifth-liter sampling was the best available data to inform this analysis at the time the analysis was conducted.

[31] With the exception of the Navajo Nation, the EPA Regions are the primacy agencies for Tribal water systems.

[32] The five lead 90th percentile classifications are: lead 90th percentile (P90) ≤ 5 μg/L; 5 μg/L < P90 ≤ 10 μg/L; 10 μg/L < P90 ≤ 12 μg/L; 12 μg/L < P90 ≤ 15 μg/L; and P90 > 15 μg/L.

A total of 93,882 lead and copper sample results were submitted by the 1,373 CWSs in Michigan that sampled during January 2019 through December 2021. The following QA steps were applied to the data to identify records suitable for analyses:

- Excluded records collected for copper.
- Substituted 1 µg/L for all concentrations <1 µg/L in the original dataset.
- Excluded data from 10 systems that were not included in the SDWIS/Fed 2020 fourth quarter frozen dataset. Thus, the EPA did not have needed information for the EA, such as CCT status, population served, and 90th percentile data.
- Classified systems as non-lead service line systems if they collected only first-liter samples based on 2020 and 2021 compliance samples and were listed in Michigan's preliminary distribution system materials inventory (Michigan EGLE, 2020) with 0 values for "known lead" service line materials, "unknown – likely lead" service line materials, and "unknown – No information" service line materials.
- Assumed systems that collected paired first- and fifth-liter samples had LSLs or if the system was listed as having "known lead" based on Michigan's preliminary distribution system materials inventory (Michigan EGLE, 2020).

3.2.8 Data Sources for Schools, Child Care Facilities, Local Health Agencies, and Targeted Medical Providers

The number of schools, child care facilities, local health agencies, and targeted medical providers are inputs in calculating the costs and benefits of the final LCRI given the school and child care facility sampling and public education requirements of the final rule. Sections 3.2.8.1 through 3.2.8.3 describe the data sources used to estimate the number of these facilities.

3.2.8.1 Schools

The EPA primarily used information from the United States Department of Education's National Center for Education Statistics (NCES) to estimate the number of elementary and secondary schools, both public and private, for each State (including Washington, D.C.), United States territories, and on tribal lands operated by the Bureau of Indian Education (BIE). For public schools, the EPA used 2018 -2019 data from "Table 216.70. Public elementary and secondary schools, by level, type, and State or jurisdiction: 1990-91, 2000-01, 2010-11, and 2018-19" (NCES, 2020a). For private schools, the EPA used "Table 15: Number of private schools, students, full-time equivalent (FTE) teachers, and 2018-2019 high school graduates, by State: United States, 2019–2020 from the NCES Private School Universe Survey" (NCES, 2020b). The EPA supplemented the NCES data with other sources[33] to estimate the number of public and private schools in the Navajo Nation and the number of private schools in United States

[33] *Table 1: List of Tribal Public Schools Managed by the Bureau of Indian Education* was obtained from this website on April 30, 2020: https://www.bie.edu/Schools/index.htm. Other sources were identified through an internet search on schools in the Navajo Nation and in U.S. Territories conducted in March of 2020. For detailed findings, see the derivation file, "Schools_Child Care Inputs_Final.xlsx", worksheets "NN Pub Priv & CC" and "Private and CC for Territories".

territories (American Samoa, Guam, Northern Marianas, Puerto Rico, and the United States Virgin Islands). None of the data sources differentiate elementary vs. secondary schools, so the EPA used the proportion of elementary to secondary public schools per State, United States territory, and BIE-operated schools from NCES (NCES, 2020a) to estimate the proportion of elementary to secondary private schools by State, United States territories, and the Navajo Nation. The EPA supplemented the NCES data with other sources to estimate the number of public and private schools in the Navajo Nation and the number of private schools in United States territories (American Samoa, Guam, Northern Marianas, Puerto Rico, and the United States Virgin Islands). The estimated total number of schools (public and private, elementary and secondary in all States and territories) inclusive of NTNCWSs is 131,264. See the file “School_Child Care Inputs_Final.xlsx” for details.

The estimated number of schools was adjusted to remove the 3,406 public schools and 1,951 private schools reported in SDWIS/Fed as NTNCWSs, as of December 31, 2020. The adjusted number of public and private schools is 96,691 and 29,221, respectively.

3.2.8.2 Child Care Facilities

The EPA used data from the 2019 Committee for Economic Development (CED) report analyzing the role of child care facilities in the economy (CED, 2019). The data for this report was collected in 2017. The EPA specifically used the information from “Figure 24: Comparative Cost of Child Care (2017)” of the CED report. The EPA supplemented CED data with additional web-based information on the number of child care facilities in the Navajo Nation and in United States territories. See the file “School_Child Care Inputs_Final.xlsx” for details.

The EPA adjusted the estimated number of United States child care facilities (674,794) to remove the 1,252 child care facilities reported in SDWIS/Fed as NTNCWSs, as of December 31, 2020. The adjusted number of child care facilities is 673,542.

3.2.8.3 Local Health Agencies and Targeted Medical Providers

The EPA used the following sources to estimate the number of local health agencies and medical providers that are obstetricians/gynecologists (ob/gyn) and pediatricians in the United States:

- National Association of County and City Health Officials (NACCHO) 2019 National Profile of Local Health Departments (NACCHO, 2019): This source estimated the number of local health agencies at 2,459.[34]
- The number of ob-gyns (20,700), pediatricians (30,200), and family medicine physicians (107,700) is from the U.S. Bureau of Labor Statistics’ “Occupational Outlook Handbook” (U.S. Bureau of Labor Statistics, 2021). The EPA downloaded the section that is specific to Physicians

[34] A 2020 report was not available. NACCHO uses a database of local health departments based on previous profile studies and consults with state health agencies and State Associations of Local Health Officials (SACCHOs) to identify local health departments for inclusion in the study population. For the 2019 Profile study, a total of 2,459 local health departments were included in the study population. Rhode Island was excluded from the study because the state health agency operates on behalf of local public health and has no sub-state units. For the first time, Hawaii was included.

and Surgeons on September 8, 2021, and used the information presented in the "Work Environment" section for these three categories of physicians.

Using the sources listed above, the EPA estimated that there are 161,059 local health agencies, ob/gyns, pediatricians, and family medicine physicians in the United States.

3.3 Drinking Water System Baseline

This section presents the following baseline characterizations for the purposes of estimating costs and benefits for the final LCRI:

- **Section 3.3.1** provides a characterization of the inventory of CWSs and NTNCWSs that are subject to the lead and copper regulations.
- **Section 3.3.2** includes the population served by CWSs and NTNCWSs and the number of households served by CWSs.
- **Section 3.3.3** includes the derivation of the number of CWSs and NTNCWSs with existing CCT from SDWIS/Fed data, current through December 2020.
- **Section 3.3.4** provides the characterization of service line material for CWSs and NTNCWSs.
- **Section 3.3.5** details how lead and copper 90th percentile data and individual lead sampling data were used to characterize water systems.
- **Section 3.3.6** provides treatment plant characteristics used to determine treatment costs.
- **Section 3.3.7** provides the derivation of initial lead and copper tap sampling based on SDWIS/Fed data, current through December 2020.
- **Section 3.3.8** provides the derivation of initial WQP monitoring schedules based on SDWIS/Fed data, current through December 2020.
- **Section 3.3.9** provides the derivation of the percent of systems that annually add a new source or treatment from SDWIS/Fed data, current through December 2020.
- **Section 3.3.10** details the derivation of the number of schools, child care facilities, and targeted medical providers as well as the estimated percent of schools and child care facilities for which a CWS would receive a waiver from the testing requirements under the final LCRI.
- **Section 3.3.11** describes the derivation of PWS and State labor rates.

Each section includes a characterization of the baseline for CWSs, followed by NTNCWSs, if applicable, and a characterization of data limitations and uncertainty.

With respect to CCT and LSL status, the EPA contacted 21 of the CWSs serving more than one million people in 2020 for information. Whenever possible, the EPA used this system-specific information instead of the estimated values presented in this section for systems serving greater than one million people in the cost and benefits analysis. See Chapter 4, Section 4.2.3 and Appendix B, Section B.2.3 for additional information on the data collected for systems serving greater than one million people.

3.3.1 Water System Inventory

A key component of the baseline is the inventory of systems subject to the pre-2021 LCR. As shown in Exhibit 3-2, 40,113 of 49,529 (about 81 percent) of all CWSs serve 3,300 or fewer people, and the 26,816 CWSs serving 500 or fewer account for about 54 percent of all CWSs. The 8,400 CWSs serving 3,301 – 50,000 people comprise about 17 percent of all CWSs, and the 1,016 CWSs serving 50,000 or more people account for only about 2 percent. Most CWSs (37,904 or about 77 percent) use GW as their primary source. However, most of the 4,390 CWSs serving above 10,000 people are classified as SW systems (2,788 CWSs or about 64 percent).

Exhibit 3-2: Inventory of CWSs

System Size (Population Served)	CWSs		
	Ground Water	Surface Water	Total
	A	B	C = A + B
≤100	10,809	923	11,732
101–500	13,028	2,056	15,084
501–1,000	4,168	1,162	5,330
1,001–3,300	5,502	2,465	7,967
3,301–10,000	2,795	2,231	5,026
10,001–50,000	1,365	2,009	3,374
50,001–100,000	161	410	571
100,001–1M	74	347	421
> 1M	2	22	24
TOTAL	**37,904**	**11,625**	**49,529**

Sources: SDWIS/Fed fourth quarter 2020 "frozen" dataset that contains information reported through December 31, 2020. Includes all active CWSs. See Section 3.2.1.1 for detail on system classification (system type, source water type, and population served using SDWIS). Additional information can be found in "CWS Inventory Characteristics_Final.xlsx" available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.
Notes:
A, B: Includes 19 CWSs serving 10,000 or fewer people for which no primary source water type was reported to SDWIS/Fed. These systems were assigned to the source type of GW or SW based on the ratio of systems with known GW to SW source type for each size category. Based on this ratio, 16 systems were assigned to the source type of GW and three to SW.

As shown in Exhibit 3-3, 17,217 of 17,418 (about 99 percent) of all NTNCWSs serve 3,300 or fewer people. The 199 NTNCWSs serving 3,301 – 50,000 people account for approximately one percent of all NTNCWSs. Only two NTNCWSs (0.01 percent) serve more than 50,000 people and none serve more than 1 million people. Most NTNCWSs (16,633 or about 95 percent) use GW as their primary source. Eighteen (46 percent) of those serving 10,001 to 100,000 people use GW versus SW and the one system serving 100,001 to 1 million people is classified as a SW system.

Exhibit 3-3: Inventory of NTNCWSs

System Size (Population Served)	NTNCWSs		
	Ground Water	Surface Water	Total
	A	B	C=A+B
≤100	8,138	250	8,388
101–500	6,133	247	6,380
501–1,000	1,489	89	1,578
1,001–3,300	752	119	871
3,301–10,000	103	59	162
10,001–50,000	18	19	37
50,001–100,000	0	1	1
100,001–1M	0	1	1
> 1M	0	0	0
TOTAL	**16,633**	**785**	**17,418**

Sources: SDWIS/Fed fourth quarter 2020 "frozen" dataset that contains information reported through December 31, 2020. Includes all active NTNCWSs. See Section 3.2.1.1 for detail on system classification (system type, source water type, and population served using SDWIS). Additional information can be found in "NTNCWS Inventory Characteristics_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

A: Includes 8 NTNCWSs serving 3,300 or fewer people for which no primary source type was reported to SDWIS/Fed. These systems were assigned to the source water type of GW or SW based on the ratio of systems with known GW to SW source type for each size category. The majority of small NTNCWSs are GW systems and based on these ratios, all 8 systems were assigned to the source type of GW.

3.3.1.1 Discussion of Data Limitations and Uncertainty

As described in Section 3.2.1.4.1, the EPA periodically performed program reviews to verify inventory information in SDWIS/Fed. From 2006 to 2016, the EPA identified only 82 individual discrepancies (<1 percent), although some discrepancies in the reviews conducted prior to August 2007[35] could be unrelated to the population, source type, or system type, such as contact information or address, based on a detailed review of 2,180 systems, indicating a high level of completeness and accuracy. Although the EPA has information that shows a low discrepancy rate from program reviews conducted during 2006 - 2016, the agency does not have current national information on discrepancy rates for 2017 – 2020, which are the last four years of the frozen 2020 SDWIS/Fed dataset used for the EA. Thus, the EPA cannot state with certainty if the discrepancy rate for 2017 – 2020 is similar to that found for 2006 – 2016. However, the EPA continues to evaluate compliance with the pre-2021 LCR through file reviews with the goal of helping States improve their programs.

There is uncertainty in the approach used to assign source water type to PWSs where no primary source type was reported to SDWIS/Fed. The EPA assumed that the systems with an unknown source would

[35] As previously discussed in Section 3.2.1.4.1, the review policy changed in August 2007 to no longer include the administrative contact or address and to only identify water system inventory discrepancies that impacted monitoring requirements, such as a change in population.

have the same proportion of GW to SW source types as the overall population of PWSs. This could result in an under or overestimate of costs in those instances where the cost model inputs vary by source type, *e.g.*, number of entry points per system. However, the EPA expects the impact to be low because systems with no source type in SDWIS/Fed represent a small proportion of systems subject to the rule. Specifically, they comprise 19 or 0.04 percent of the total 49,529 CWSs and 8 or 0.05 percent of the total 17,418 NTNCWSs or 0.04 percent of all systems subject to the rule and all serve 10,000 or fewer people.

3.3.2 Population and Households Served

An accurate characterization of the populations served by water systems is necessary when assessing the potential benefits of the final LCRI. Population served is also used to estimate volume of water treated and associated CCT costs.

SDWIS/Fed tracks "retail" population served, meaning that it counts only the population that purchase water directly from the water system and does not include the population of a water system that purchase water from another system. Consecutive water systems are recorded in SDWIS/Fed as a separate system with a unique public water system identification (PWSID) number.

Exhibit 3-4 and Exhibit 3-5 show the total population served and average population served per system by size category for both CWSs and NTNCWSs, respectively. Each exhibit is organized by source water type (SW or GW) and is based on SDWIS/Fed fourth quarter 2020 "frozen" dataset that contains information reported by States through December 31, 2020.

Because systems often pass their costs onto customers in the form of rate increases, the final LCRI cost analysis also includes analyses to assess the impact of the requirements on a household level. The number of households served by CWSs expected to be subject to the final LCRI requirements is estimated by dividing the population for each system size category by the average number of people per household. For CWSs, the EPA assumed an average of 2.53 persons per household based on 2020 United States Census data (United States Census Bureau, 2020). This information is also included in Exhibit 3-4 by system size and source type. NTNCWSs do not serve households and thus, this information is not included in Exhibit 3-5.

As shown in Exhibit 3-4, although CWSs serving 3,300 or fewer account about 81 percent of all CWSs, they serve fewer than eight percent of the population and households that receive their water from a CWS. On the other hand, although CWSs serving more than 50,000 people account for only two percent of all CWSs, they serve more than half (59 percent) of the population and households that receive their water from a CWS.

Exhibit 3-4: Population and Number of Households Served by CWSs

System Size (Population Served)	Ground Water			Surface Water			TOTAL (Includes 19 CWSs with unspecified primary source)		
	Population Served	Average Population Per System	Number of Households Served	Population Served	Average Population Per System	Number of Households Served	Population Served	Average Population Per System	Number of Households Served
	A	B	C = A/2.53	D	E	F=D/2.53	G=A+D	H	I=G/2.53
≤100	658,125	61	260,128	49,688	54	19,640	708,236	60	279,935
101–500	3,249,684	249	1,284,460	578,788	282	228,770	3,830,126	254	1,513,884
501–1,000	3,058,307	734	1,208,817	870,975	750	344,259	3,931,488	738	1,553,948
1,001–3,300	10,267,678	1,866	4,058,371	4,950,969	2,009	1,956,905	15,218,647	1,910	6,015,275
3,301–10,000	15,898,651	5,688	6,284,052	13,660,859	6,123	5,399,549	29,565,710	5,883	11,686,051
10,001–50,000	28,316,279	20,745	11,192,205	45,846,395	22,821	18,121,105	74,162,674	21,981	29,313,310
50,001–100,000	10,785,606	66,991	4,263,085	28,843,811	70,351	11,400,716	39,629,417	69,404	15,663,801
100,001–1M	14,963,849	202,214	5,914,565	84,395,513	243,215	33,357,910	99,359,362	236,008	39,272,475
> 1M	3,400,000	1,700,000	1,343,874	43,238,891	1,965,404	17,090,471	46,638,891	1,943,287	18,434,344
TOTAL	**90,598,179**	**2,390**	**35,809,557**	**222,435,889**	**19,134**	**87,919,324**	**313,044,551**	**6,320**	**123,733,024**

Sources: A, B, D, and E: SDWIS/Fed fourth quarter 2020 “frozen” dataset that contains information reported through December 31, 2020. See file “CWS Inventory Characteristics_Final.xlsx,” available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov. Note that for CWSs in the size category of serving ≤100 people in which the reported population was < 24 people, the EPA increased the population to 25. This resulted in an increase in total population change from 701,258 to 708,236 for this size category.

Notes:

B, E, and H: Derived by dividing the population served by the number of systems presented in Exhibit 3-2.

C, F, and I: The average of 2.53 persons per household is from 2020 Census data (Table AVG1. Average Number of People per Household, by Race and Hispanic Origin, Marital Status, Age, and Education of Householder: 2020).

G-I: CWSs with unreported primary source were not summarized individually, however they were included in the “TOTAL” columns. Thus, the “TOTAL” column reflects an additional 19 CWSs with unreported primary source type.

As previously discussed, NTNCWSs serving 3,300 or fewer account for approximately 99 percent of all NTNCWSs. As shown in Exhibit 3-5, these systems serve approximately 71 percent of the population that receives their water from a NTNCWS. Those serving 3,301 to 50,000 people and more than 50,000 people serve approximately 25 percent and four percent of the population that receives water from a NTNCWS, respectively.

Exhibit 3-5: Population Served by NTNCWSs

System Size (Population Served)	Ground Water		Surface Water		TOTAL	
	Population Served	Average Population Per System	Population Served	Average Population Per System	Population Served	Average Population Per System
	A	B	D	E	F	G
≤100	454,125	56	12,498	50	466,808	56
101–500	1,522,528	248	66,010	267	1,588,708	249
501–1,000	1,060,097	712	66,567	748	1,126,664	714
1,001–3,300	1,254,365	1,675	232,569	1,954	1,493,446	1,715
3,301–10,000	542,409	5,266	350,086	5,934	892,495	5,509
10,001–50,000	330,457	18,359	410,046	21,581	740,503	20,014
50,001–100,000	0	0	71,963	71,963	71,963	71,963
100,001–1M	0	0	203,375	203,375	203,375	203,375
> 1M	0	0	0	0	0	0
TOTAL	**5,163,981**	**310**	**1,413,114**	**1,800**	**6,583,962**	**378**

Sources: SDWIS/Fed fourth quarter 2020 "frozen" dataset that contains information reported through December 31, 2020. See file "NTNCWS Inventory Characteristics_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

B, E, and G: Derived by dividing the population served by the number of systems presented in Exhibit 3-3.

F and G: NTNCWSs with unreported primary source were not summarized individually, however they were included in the "TOTAL" columns. Thus, the "TOTAL" column reflects an additional eight systems with unspecified primary source.

3.3.2.1 Discussion of Data Limitations and Uncertainty

As described in Section 3.2.1.4.1, the EPA periodically performs Program Reviews to verify key parameters in SDWIS/Fed including, but not limited to, population served, system type, and source type (USEPA, 2007). From 2006 to 2016, the EPA identified only 82 individual water system inventory discrepancies (<1 percent) based on a detailed review of 2,180 systems, although some discrepancies could be unrelated to the population, source type, or system type, such as contact information or address. The results of the Program Review indicate a high level of completeness and accuracy in the SDWIS/Fed population data (USEPA, 2007). Also as noted in Section 3.3.1.1, the EPA does not have current national information on discrepancy rates for 2017 – 2020, which are the last four years of the frozen 2020 SDWIS/Fed dataset used for this EA. Thus, the EPA cannot state with certainty if the discrepancy rate for 2017 – 2020 is similar to that found for 2006 – 2016. However, the EPA continues to

evaluate compliance with the pre-2021 LCR through file reviews with the goal of helping States improve their programs.

As noted previously, the EPA consistently classifies systems in SDWIS/Fed according to the retail population served by the system and does not include the population served by wholesale customers. Wholesale customers that purchase water from another system and meet the PWS definition have their own unique PWSID, retail population, and associated regulatory requirements under the SDWA. As described in Chapter 4, Section 4.3.3, the EPA uses retail population to estimate design and average daily flow parameters, which are then used to estimate CCT costs associated with the rule. Use of retail population may overestimate costs by assuming that each PWSID will have an individual treatment plant instead of the more common scenario of the seller having one large plant and selling treated water to its wholesale customers.

3.3.3 Corrosion Control Treatment (CCT) Status

Under the pre-2021 LCR, the 2021 LCRR, and the final LCRI, systems with CCT in place have different requirements than those without this treatment. This section includes the EPA's derivation of the number of CWSs and NTNCWSs with CCT. As noted in the introduction to Section 3.3, the EPA used system specific CCT information for systems serving greater than one million people where available.

To estimate the percent of CWSs and NTNCWSs with CCT, the EPA used one approach for systems serving 50,000 or fewer people and a different approach for those systems serving more than 50,000 people. Both approaches rely on information reported to SDWIS/Fed but use different data fields and assumptions. Systems serving 50,000 or fewer are required under the pre-2021 LCR to install CCT if they have a lead and/or copper ALE.[36] As a first step, the EPA identified CWSs and NTNCWSs for which the State reported a treatment objective of "C" to identify those with CCT. As noted in Section 3.2.1.4, treatment code data in SDWIS/Fed is not part of the program review; thus, there is more uncertainty associated with these data as compared to SDWIS/Fed population and violation data. Therefore, to supplement the treatment code analysis, the EPA reviewed milestone and violation data to identify additional CWSs that were required to install CCT as follows:

- The State reported a "DONE" or "DEEM" milestone with a reason code of "WQP." This indicates systems for which the State has set OWQPs, and thus would have CCT.[37]
- The system was in violation for failure to install CCT (*i.e.*, was assigned violation code 58) and subsequently addressed this violation. Systems with an addressed code 58 violation were identified by the enforcement code of "SOX" or "EOX" that denotes compliance achieved.

[36] A system serving 50,000 or fewer is triggered into CCT steps that can include a study prior to CCT installation. However, these systems can discontinue CCT steps if they have two consecutive six-month monitoring periods at or below both the lead and copper ALs. If they have a subsequent ALE, they must recommence CCT steps but can discontinue the steps if they again have no ALEs for two consecutive six-month monitoring periods.

[37] Following the installation of CCT, the State will set OWQPs that represent the conditions under which systems must operate their CCT to most effectively minimize the lead and copper concentrations at their users' taps while not violating any National Primary Drinking Water Regulation.

- The system has an OWQP (59) violation code. As noted above, OWQPs are set for systems with CCT.
- The system purchased water from another system that the EPA has identified as having CCT.

CWSs and NTNCWSs serving more than 50,000 people were required under the pre-2021 LCR to install CCT unless they: 1) had completed treatment steps that are equivalent to those described in the 1991 LCR prior to December 7, 1992 (*i.e.*, meet the criteria of 40 CFR 141.81(b)) or 2) could demonstrate they have very low levels of lead and copper in the distribution system (*i.e.*, qualify as a “b3” system).[38] Therefore, the EPA classified all systems as having CCT except those identified as a b3 system. The EPA used the following criteria to identify b3 systems:

- Had a reported “b3” milestone,
- Did not have CCT using the criteria described above for systems serving ≤ 50,000 people, and
- Did not have a lead or copper ALE from 1992–2020 and all reported lead 90th percentile levels are ≤ 5 µg/L or non-detect.

Only 16 CWSs were found to be b3 systems.

As shown in Exhibit 3-6, the EPA estimated that overall, approximately 31 percent of all CWSs have CCT. The percentage of CWSs with CCT is higher in the larger size categories. Specifically, about 24 percent of CWSs serving 3,300 or fewer have CCT. Whereas, approximately 59 percent of those serving 3,301 to 50,000 people and approximately 98 percent of those serving more than 50,000 people have CCT.

As shown in Exhibit 3-7, the EPA estimated that overall, approximately 12 percent of all NTNCWSs have CCT. Approximately 12 percent of those serving 3,300 or fewer and 20 percent of those serving 3,301 to 50,000 people have CCT. No NTNCWS met the b3 criteria; thus, the EPA assumed all NTNCWSs serving more than 50,000 people had CCT.

[38] “b3 systems” is an abbreviated term for those systems that meet the criteria in 40 CFR 141.81(b)(3). Specifically, under the pre-2021 LCR, for two consecutive six-month monitoring periods, the system’s: 1) 90th percentile lead level minus the highest source water level is < 0.005 mg/L (*i.e.*, 5 µg/L); *or* 2) source water lead levels are below the method detection limit (MDL) *and* the 90th percentile lead level is ≤ 0.005 mg/L. As stated above, the EPA applied more stringent criteria in its analysis by limiting the b3 criteria to system serving more than 50,000 people for which all reported lead 90th percentile levels were ≤ 0.005 mg/L.

Exhibit 3-6: Number of CWSs with and without CCT

System Size (Population Served)	Number of CWSs with CCT			Number of CWSs without CCT			TOTAL
	Ground Water	Surface Water	Total	Ground Water	Surface Water	Total	
	A	B	C=A+B	D	E	F=D+E	G=C+F
≤100	985	405	1,390	9,824	518	10,342	11,732
101–500	2,120	926	3,046	10,908	1,130	12,038	15,084
501–1,000	1,077	584	1,661	3,091	578	3,669	5,330
1,001–3,300	1,851	1,525	3,376	3,651	940	4,591	7,967
3,301–10,000	1,171	1,566	2,737	1,624	665	2,289	5,026
10,001–50,000	693	1,550	2,243	672	459	1,131	3,374
50,001–100,000	158	402	560	3	8	11	571
100,001–1M	72	344	416	2	3	5	421
> 1 M	2	22	24	0	0	0	24
TOTAL	**8,129**	**7,324**	**15,453**	**29,775**	**4,301**	**34,076**	**49,529**

Source: SDWIS/Fed fourth quarter 2020 “frozen” dataset that contains information reported through December 31, 2020. See file, “CWS Inventory Characteristics_Final.xlsx,” available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

D & E: Includes 19 CWSs serving 10,000 or fewer people with no CCT for which no primary source type was reported to SDWIS/Fed. These systems were assigned to the source type of GW or SW based on the ratio of systems with known GW to SW source type for each size category. Based on this ratio, 16 systems were assigned to the source type of GW and three to SW. All CWSs identified as having CCT had a reported source type.

Exhibit 3-7: Number of NTNCWS with and without CCT

System Size (Population Served)	Number of NTNCWSs with CCT			Number of NTNCWSs without CCT			TOTAL
	Ground Water	Surface Water	Total	Ground Water	Surface Water	Total	
	A	B	C=A+B	D	E	F=D+E	G=C+F
≤100	704	25	729	7,434	225	7,659	8,388
101–500	823	46	869	5,310	201	5,511	6,380
501–1,000	255	22	277	1,234	67	1,301	1,578
1,001–3,300	160	28	188	592	91	683	871
3,301–10,000	25	9	34	78	50	128	162
10,001–50,000	3	2	5	15	17	32	37
50,001–100,000	0	1	1	0	0	0	1
100,001–1M	0	1	1	0	0	0	1
> 1 M	0	0	0	0	0	0	0
TOTAL	**1,970**	**134**	**2,104**	**14,663**	**651**	**15,314**	**17,418**

Source: SDWIS/Fed fourth quarter 2020 "frozen" dataset that contains information reported through December 31, 2020. See file, "NTNCWS Inventory Characteristics_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

D: Includes eight NTNCWSs serving 3,300 or fewer people with no CCT for which no primary source type was reported to SDWIS/Fed. These systems were assigned to the source type of GW or SW based on the ratio of systems with known GW to SW source type for each size category. The majority of small NTNCWSs are GW systems and based on these ratios, all eight systems were assigned to the source type of GW. All NTNCWSs identified as having CCT had a reported source type.

3.3.3.1 Discussion of Data Limitations and Uncertainty

There is uncertainty in the estimated percent of CWSs and NTNCWSs with CCT. For systems serving more than 50,000 people, the assumptions are based on the pre-2021 LCR requirements that all systems must install CCT unless they had installed it previously (*i.e.*, as required in the 1991 rule) or have very low lead and copper levels, which signifies that they have naturally non-corrosive water (*i.e.*, they are b3 systems). Therefore, the uncertainty in these estimates is not expected to have a significant impact on benefits and costs of the final LCRI. For systems serving 50,000 or fewer people, the EPA recognizes greater uncertainty in using treatment objective code data from SDWIS/Fed to identify systems with CCT. Thus, the EPA supplemented these data with milestone and violation information to identify those systems that would have been required to install CCT under the pre-2021 LCR. The EPA recognizes that it is unlikely that SDWIS/Fed contains complete and current treatment and milestone data for all water systems, especially for smaller water systems. The uncertainty in the percent of systems with CCT may result in an under or overestimate of costs and benefits of the final LCRI.

3.3.4 Service Line Material Characterization

The characterization of service line material and the characterization of systems based on their mix of service line materials are key inputs to calculating the costs and benefits of the final LCRI. Sections 3.3.4.1 and 3.3.4.2 provide the detailed characterization of service line material for CWSs and NTNCWSs, respectively. Section 3.3.4.3 follows with a discussion of current State regulations related to service line replacement that impact the estimated cost of service line replacement under the LCRI requirements.

3.3.4.1 Service Line Material Characterization for CWSs

This introductory section presents:

- The EPA's rationale for using the 7th DWINSA results (including results from the one-time update) as the primary data source for service line material characterization.
- An explanation of the differences in classification of service line material between this EA and the analysis conducted for the 7th DWINSA LSL Drinking Water State Revolving Fund (DWSRF) allocation.
- How this analysis classifies systems based on their mix of service line material.

Sections 3.3.4.1.1 and 3.3.4.1.2 follow with the characterization of CWSs based on service line material and the characterization of service line materials within those CWSs, respectively. Estimates for NTNCWSs are in Section 3.3.4.2.

The EPA reviewed available national scope data sources for characterizing service line material types. The *Economic Analysis for the Final Lead and Copper Rule Revisions* (hereafter referred to as the "Final 2021 LCRR EA") (USEPA, 2020a) used two datasets to characterize LSLs based on surveys done by the American Water Works Association (AWWA).[39] Since the 2021 LCRR was finalized, LSL survey data from

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[39] The sources were: (1) the Lead Information Survey conducted by AWWA in 1989, as published in the USEPA. 1991. *Final Regulatory Impact Analysis of National Primary Drinking Water Regulations for Lead and Copper*. April

the 7th DWINSA, collected primarily from February 2021 – December 2021, have become available. As described in Section 3.2.5, the 7th DWINSA surveyed: all systems in the country serving more than 100,000 people, a per-State sample of systems serving between 3,301 and 100,000 people, and a national sample of systems serving 3,300 or fewer people. In addition to information on the presence of LSL, the 7th DWINSA is the first time that comprehensive national data has been collected on galvanized service lines requiring replacement (GRR) and lead connectors. The 7th DWINSA is the largest and broadest scope data collection effort since the survey's inception in 1995. The dataset contains a wide range of responses from small, medium, and large systems, and from urban and rural systems. The response rate for the survey overall was 97 percent, with the response rate for the supplemental LSL questionnaire being lower but still high at 80 percent. Furthermore, systems were assigned sample weights to improve the degree to which surveyed systems were representative of systems within their assigned strata.[40] Due to the extensiveness and representativeness of the dataset and the detailed information gathered on service line material, the EPA used the 7th DWINSA results to characterize service line material for this EA in place of the two previous AWWA surveys.

The 7th DWINSA asked systems for detailed information on service line material including the number of service lines for the following material categories:

- Lead Pipe - Service lines that contain any lead pipe.
- Lead Connectors - Service lines that do not contain any lead pipe but have lead connectors such as goosenecks or pigtails.
- Galvanized/Lead Pipe - Service lines that contain galvanized pipe and were previously downstream from a lead pipe that was removed from the service line.
- Galvanized/Lead Connector - Service lines that contain galvanized pipe and were previously downstream from a lead connector that was removed from the service line.
- Galvanized/Unknown Lead - Service lines that contain galvanized pipe and were previously downstream of an unknown source of lead that was removed from the service line.
- Galvanized/Standalone - Service lines that contain galvanized pipe that have never been downstream from any lead pipe or lead connector in the service line.
- No Lead or Galvanized - Service lines that do not contain any lead pipe or galvanized pipe and do not have lead connectors.
- Unknown - Service lines for which the material makeup of the service line and of the connector are not known.
- Unreported – Services lines for which the system did not provide any information on their material.

1991. Office of Water, and (2) AWWA surveys conducted in 2011 and 2013, results published in Cornwell, D.A, R.A. Brown, and S.H Via. 2016. National Survey of Lead Service Line Occurrence. *Journal AWWA*. 108(4):E182-E191.

[40] See Section 3.2.5 for an explanation of the DWINSA system sampling weights.

As described in Section 3.2.5, the EPA provided a one-time opportunity for previously surveyed water systems to update their 7th DWINSA service line material questionnaire responses. This update, conducted between September - November 2023, allowed these water systems and States to revise their original response based on new service line inventory information or to provide a response if they had not participated previously. Participation in this update was voluntary and limited to the service line material questionnaire. For the one-time update, the EPA simplified the questionnaire, merging the categories of galvanized previously downstream of lead pipe, galvanized previously downstream of unknown pipe, and galvanized previously downstream of lead connectors.

The EPA combined the new data from this update with the original 7th DWINSA, replacing the system level data where new information was available. This combined dataset is referred to as the "DWINSA LSL Allocation Model" throughout this document. The EPA used this model to generate ratios of lead, non-lead, unknown, and unreported service lines for each State.[41] These ratios were applied to the total number of service lines in the State to generate the counts in each category. For small systems and States lacking sufficient data for State-specific models, the EPA used ratios based on national data.[42] The results are used by the EPA to allocate DWSRF grants, including funding from the Bipartisan Infrastructure Law, to States. This allocation model was also used by the EPA to characterize service line material for this EA.

To be consistent with the final LCRI regulatory definitions, the EPA combined some of the service material categories for this EA. See Exhibit 3-8 for a comparison of LCRI and DWINSA categories. For the purposes of these analyses, the EPA uses the term ***lead content service lines*** to indicate the broader group of service lines that are LSLs, GRR service lines, lead connectors, and galvanized previously downstream of lead connectors. The EPA also tracks ***unknown service lines*** because the EPA estimates that systems will incur burden and costs as they investigate their unknowns, prepare their service line inventory updates, and replace unknowns that are found to be lead or GRR service lines under the final LCRI. For the purposes of the final LCRI, the EPA grouped the unreported responses to the survey with the unknown responses. This may result in an overestimate of the unknown service lines, as some systems may have elected not to complete the service line questions as opposed to not knowing their service line material. As will be discussed later in this section, the EPA estimates that a portion of the unknown service lines will be found to have lead content.

[41] Note the DWINSA LSL Allocation Model calculates service line characteristic ratios at the state level using sample weights which reflect the probability of a system being sampled. The DWINSA LSL Allocation Model does not estimate service line characteristic ratios by system size. The number of service lines per system varies within each state, which adds uncertainty to the estimate of the total number of service lines. The additional steps taken to estimate SL ratios and counts by system size are presented in the remainder of this section.

[42]For small systems state level SL counts the use of national ratios will introduce additional uncertainty into the state specific estimates. However, because the small system survey sample design and weights are designed to be nationally representative, using the national ratios in place of state values (when there is insufficient state level data) does not result in additional uncertainty in the final national estimates used in the LCRI analysis.

Exhibit 3-8: Relationship between Service Line Categories in the Final LCRI Economic Analysis, the 7th DWINSA, and the DWINSA One-time Update

<table>
<tr><th colspan="2">LCRI Service Line Category[1]</th><th>7th DWINSA Service Line Category</th><th>DWINSA One-time Update Service Line Category</th></tr>
<tr><td rowspan="4">Lead Content Service Lines</td><td>Lead Service Line (LSL)</td><td>Lead Pipe</td><td>Lead Pipe</td></tr>
<tr><td>Galvanized Requiring Replacement (GRR) Service Line</td><td>Galvanized/Lead Pipe
Galvanized/Unknown</td><td>Galvanized/Lead Pipe</td></tr>
<tr><td>Lead Connectors</td><td>Lead Connectors</td><td>Lead Connectors</td></tr>
<tr><td>Galvanized Previously Downstream of Lead Connectors</td><td>Galvanized/Lead Connectors</td><td>Galvanized/Lead Pipe</td></tr>
<tr><td colspan="2" rowspan="2">Unknown</td><td>Unknown</td><td>Unknown</td></tr>
<tr><td>Unreported[2]</td><td>Unreported[2]</td></tr>
<tr><td colspan="2">Non-Lead</td><td>No Lead or Galvanized
Galvanized/Standalone</td><td>No Lead or Galvanized
Galvanized/Standalone</td></tr>
</table>

Notes:
1. The final LCRI service line categories match the regulatory definitions. For the purposes of this EA, the first 4 rows represent "lead content service lines."
2. While the DWINSA LSL Allocation Model maintained the distinction between unknown and unreported service lines but applied the same method to estimate the proportion of these respective categories of service lines that are lead, this analysis groups unreported service lines with unknowns. The results of this approach are the same in this EA and the DWINSA LSL Allocation Model.

Solely for the purposes of modeling LCRI costs and benefits using the SafeWater LCR model, the EPA also categorized ***systems*** based on their mix of service line material as follows:

- Category 1: Systems with any known lead content service lines.
- Category 2: Systems with all non-lead service lines.
- Category 3: Systems with all unknown content (*i.e.*, unknown) service lines.
- Category 4: Systems with a mix of non-lead and unknown service lines.

These system categories are shown in Exhibit 3-9. Note that Category 1 systems can contain known lead content, non-lead, and unknown service lines. Category 3 systems reported all unknown service lines. Category 4 systems have a mix of non-lead and unknown service lines. Note that for Categories 1, 3, and 4, some proportion of the unknown service lines were projected to be lead content service lines.

The EPA used the DWINSA LSL Allocation Model to estimate the percent of systems in each of the four categories (see the fourth column for the SafeWater LCR model [43] variable name). The EPA also used the model and decision rules to characterize the service lines for each of the four system categories (see the fifth column of Exhibit 3-9 for relevant SafeWater LCR model variable names for characterization of service lines). The detailed approach and results are described in the next two subsections.

Exhibit 3-9: CWS Categorization Based on Service Line Material

CWS Category	CWS Category Description	Types of Service Lines Within Each CWS Category	SafeWater LCR Model Variable Name for percent of SYSTEMS in the CWS category	SafeWater LCR Model Variable Names for classification of SERVICE LINES in the CWS Category
1	Systems with any known lead-content service lines	• Lead Content • Non-Lead • Unknown	*p_lsl*	• Percent of service lines with known material (*perc_lsl_known*) • Percent of known service lines that are lead (*perc_lsl_known_lead*) • Percent of unknown service lines that are found to be lead (*perc_unknown_lead*)
2	Systems with all non-lead service lines	• Non-lead	*See note 1*	• None (all are non-lead)
3	Systems with all unknown service lines	• Unknown	*p_lsl_unknown*	• Percent of unknown service lines that are found to be lead (*perc_unknown_lead*)
4	Systems with both non-lead and unknown service lines	• Non-Lead • Unknown	*p_lsl_nolead_unknown*	• Percent of service lines that are unknown (*perc_lsl_nolead_unknown_unknown*) • Percent of unknown service lines that are found to be lead (*perc_unknown_lead*)

Notes:
1. The percent of systems with all non-lead service lines is equal to 1 minus *p_lsl*, *p_lsl_unknown*, and *p_lsl_nolead_unknown*).

3.3.4.1.1 CWSs with Known or Potential Lead

This section presents the percent and number of CWSs in each of the four service line material categories: 1) any known lead content, 2) all non-lead, 3) all unknown, and 4) both non-lead and unknown. As described previously, these percentages were derived using the DWINSA LSL Allocation Model for the nine system size categories used in this EA and also by CCT status.

Exhibit 3-10 shows the percent of CWSs in service line material Categories 1 through 4 for each CCT and system size category using the DWINSA LSL Allocation Model.[44] Column G shows the estimated total

[43] See Chapter 4, Section 4.2 for an overview of the SafeWater LCR cost model.
[44] All systems serving fewer than 3,301 people were analyzed as a single bin due to the limited number of observations for systems of this size, even though they are presented separately in this analysis.

number of systems with lead content and/or unknowns, calculated by multiplying the percentages by the SDWIS/Fed 4th quarter 2020 systems data (note that SDWIS/Fed 4th quarter 2020 data is used throughout this EA for consistency). For modeling purposes, the EPA assumed that lead content service lines can be found in any system reporting unknowns. Thus, the total number of systems in Column G represents the total number of CWSs with potential lead content service lines.

The EPA recognizes the uncertainty in this assumption; some systems reporting all or some unknowns are likely to discover that they have no lead content service lines. With the current data, it is not possible to estimate the proportion of systems that will find all their unknowns to be non-lead. This assumption may overestimate the percentage of systems with potential lead content. This could result in an overestimate of systems that exceed the action level and subsequently install or change treatment, given that the EPA assumes higher lead concentrations in lead content systems vs. non-lead systems (See Section 3.3.5 for the analysis). However, this assumption does not affect the total projected number of lead content service lines that will be presented later in this section. See Section 3.3.4.1.3 for an additional discussion of uncertainty regarding the EPA's service line material characterization.

Exhibit 3-10: Percent and Number of CWSs in Service Line Material Categories

System Size (Population Served)	Number of CWSs	CCT Status	Percent of CWSs by Service Line Category				Number of CWSs with Lead Content and/or Unknowns (*i.e.*, Potential Lead Content)
			Any Lead Content (1) p_lsl	All Non-Lead (2)	All Unknowns (3) p_lsl_unknown	Non-Lead and Unknown (4) p_lsl_nolead_unknown	
	A	B	C	D	E	F	G = (C+E+F)*A
≤100	10,342	No	1.8%	53.9%	38.0%	6.3%	4,766
≤100	1,390	Yes	8.8%	47.7%	33.5%	10.0%	727
101-500	12,038	No	1.8%	53.9%	38.0%	6.3%	5,547
101-500	3,046	Yes	8.8%	47.7%	33.5%	10.0%	1,593
501-1,000	3,669	No	1.8%	53.9%	38.0%	6.3%	1,691
501-1,000	1,661	Yes	8.8%	47.7%	33.5%	10.0%	868
1,001-3,300	4,591	No	1.8%	53.9%	38.0%	6.3%	2,115
1,001-3,300	3,376	Yes	8.8%	47.7%	33.5%	10.0%	1,765
3,301-10,000	2,289	No	17.7%	39.2%	33.9%	9.2%	1,391
3,301-10,000	2,737	Yes	25.2%	35.2%	25.1%	14.5%	1,772
10,001-50,000	1,131	No	25.7%	35.1%	26.1%	13.1%	734
10,001-50,000	2,243	Yes	32.2%	25.6%	26.2%	16.0%	1,669
50,001-100,000	11	No	0.0%	46.6%	35.8%	17.6%	6
50,001-100,000	560	Yes	37.7%	23.2%	24.2%	14.9%	430
100,001-1,000,000	5	No	0.0%	28.9%	64.8%	6.3%	4
100,001-1,000,000	416	Yes	37.5%	23.2%	24.9%	14.4%	319
>1,000,000	0	No	0.0%	0.0%	0.0%	0.0%	0
> 1,000,000	24	Yes	45.8%	18.8%	20.8%	14.6%	20
Total	**49,529**						**25,416**

Notes: Category 1: systems have any lead known content service lines; Category 2: systems have all non-lead service lines; Category 3: systems have all unknown service lines; Category 4: systems have a mix of non-lead and unknown service lines. Note that Category 1 are systems with known lead content service lines, and Categories 3 and 4 are systems without known lead content lines but have potential lead content service lines.

Sources:

A: SDWIS/Fed 4th Quarter 2020 freeze. See Section 3.3.3 for the EPA's approach for assigning CCT status for each CWS.

C – F: The DWINSA LSL Allocation Model. See the file "Service Line Characterization using DWINSA_Final.xlsx", worksheet "CWS Lead Service Line Status."

G: Totals may not add due to rounding.

3.3.4.1.2 Characterization of Known and Potential Lead Content Service Lines by System Category

The previous section estimated the percentage and number of ***water systems*** (specifically CWSs) with potential lead content service lines. The next step is to estimate the number of ***service lines*** with potential lead content within those systems. In this EA, these potential lead content lines are treated as if they are in fact lead content lines. For the purposes of SafeWater LCR modeling, the EPA developed separate service line characterizations for each of the four system categories described in the previous section.

The primary purpose of the DWINSA is to allocate DWSRF funding to each State, so the DWINSA LSL Allocation Model generated ratios to calculate the number of lead, non-lead, unknown, and unreported service lines by State, not by the four system material categories or the nine system size categories needed for the final LCRI analysis. Though the DWINSA sample is large, it is not big enough to reliably estimate ratios by system size for the four system categories by state. Instead, the model is used to estimate the ratios in the aggregate. Using these results, the EPA developed the following seven-step approach to characterize service line materials for each of the four system categories as presented in the referenced exhibits:

- Step 1: Estimate the number of service lines by material type (known lead content, unknown, and non-lead) in the nation using the DWINSA LSL Allocation Model. See Exhibit 3-11.
- Step 2: Estimate the number of service lines in system Categories 1 through 4 using the DWINSA LSL Allocation Model. See Exhibit 3-12.
- Step 3: Use the results of Step 2 and decision rules to allocate the known lead content, unknown, and non-lead service lines from Step 1 to system Categories 1 through 4. See Exhibit 3-13, which includes a table for each of the four system categories.
- Step 4: Divide the results from Step 3 by the total service lines in Step 2 to calculate the percentages of each service line type per category for the SafeWater LCR model.
- Step 5: Estimate the percent of unknown service lines that are projected to be found to have lead content.
- Step 6: Use the percentages from Step 4 and 5 and the adjusted number of service lines from SDWIS/Fed 4th quarter 2020 to calculate the total number of service lines with potential lead content in each system category. See:
    - Exhibit 3-14, which presents total service lines in CWSs
    - Exhibit 3-15 for Category 1 Systems
    - Exhibit 3-16 for Category 3 Systems
    - Exhibit 3-17 for Category 4 Systems
    - Exhibit 3-18, which shows the total lead content service lines for all categories.

  Note that there is no exhibit for Category 2 systems because these systems have no potential lead content service lines.

- Step 7: Characterize the breakouts of lead content service lines, specifically what portion are LSLs, GRR, lead connectors, and galvanized lines previously downstream of lead connectors. See Exhibit 3-18.

The details of each step and results are presented below.

Step 1: Use the DWINSA LSL allocation model to estimate the total number of service lines nationally and the proportion that are known lead content, unknown, and non-lead. As noted earlier, the unreported were grouped with the unknown. Results are shown in Exhibit 3-11.

Exhibit 3-11: Characterization of Service Lines from the 7th DWINSA by Material Type and System Size

System size (population served)	Number of Service Lines Nationally from DWINSA by Material Type			Total Number of Service Lines	Estimated Percent of DWINSA Reported Unknowns that Are Projected to be Lead Content Service Lines
	Lead Content	Non-Lead	Unknown		
	A	B	C	D = A+B+C	E
	3,143	223,019	121,141	347,303	1.4%
101-500	13,824	981,072	532,907	1,527,803	1.4%
501-1,000	13,525	959,841	521,375	1,494,741	1.4%
1,001-3,300	47,831	3,394,511	1,843,860	5,286,202	1.4%
3,301-10,000	566,386	5,026,111	4,154,122	9,746,619	11.2%
10,001-50,000	1,513,830	12,327,293	9,766,986	23,608,109	12.6%
50,001-100,000	679,129	6,656,380	4,711,647	12,047,156	12.5%
100,001-1,000,000	1,591,955	16,952,488	11,504,703	30,049,146	11.5%
>1,000,000	683,352	7,965,044	5,123,021	13,771,417	10.8%
Total	5,112,975	54,485,759	38,279,762	97,878,496	

Source: DWINSA LSL Allocation Model with system weights applied to the service lines as an approximation.
Notes: The Unknown service lines in Column C include the unreported survey responses. Due to the additional size categories added for the final LCRI economic analyses, some service lines were dropped due to rounding. The EPA estimated the number of lead, non-lead, and unknown content service lines for each state. Each of these service lines was then assigned to a size category, determined by the proportion of service lines falling within each size category in the state. After completing these calculations for each state, the EPA aggregated the totals for lead, non-lead, and unknown content lines for each size category across all states. The EPA then estimated the number of unknown service lines projected to be lead by applying the ratio of known lead to the sum of known lead and non-lead service lines in each state (value in column A divided by columns A plus B but at the state level). The EPA then allocated the number of unknown service lines projected to be lead to their respective size categories, following the same proportional method used in estimating columns A-C. After completing these calculations for each state, the EPA aggregated the totals for unknown service line projected to be lead by each size category across all states. Finally, to determine the Estimated Percent of Unknowns that are projected to be lead, the EPA divided the number of unknowns projected to be lead nationally in each size category by the total number of unknown service lines nationally in that size category. Note that because EPA analyzed data by State rather than by system size, which is consistent with the 7th DWINSA-based allocation calculations, column E cannot be computed using the numbers in this table.

The total number of service lines shown in Exhibit 3-11 is **97.9 million**, which is slightly less than the reported 100 million service lines in the 7th DWINSA Fact Sheet.[45] This difference occurs because this EA used additional categories for lead content service lines, unlike the DWINSA LSL Allocation Model where these lines were combined. The additional categories resulted in smaller ratios, causing some service lines to be dropped due to rounding. Note that the data in Exhibit 3-11 are used to estimate the ***percent*** of service line material types, which are then applied in the SafeWater LCR model to adjusted SDWIS/Fed 4th Quarter 2020 connection data. Therefore, differences between the total service lines in Exhibit 3-11 and the DWINSA Fact Sheet are not expected to significantly affect the accuracy of the final LCRI cost and benefit analysis.

Step 2: Use the 7th DWINSA to estimate the total number of service lines in Categories 1 through 4. The EPA used the system weights from the 7th DWINSA as an approximation for service line weights. Results are shown in Exhibit 3-12.

Exhibit 3-12: Total Number of Service Lines in Categories 1 through 4 from DWINSA

System Size (population Served	LCRI System Categories				Total Service Lines
	Any Lead Content (1)	All Non-Lead (2)	All Unknown (3)	Non-lead and Unknown (4)	
≤100	18,759	180,285	103,421	44,838	347,303
101-500	82,523	793,085	454,953	197,243	1,527,803
501-1,000	80,737	775,922	445,108	192,974	1,494,741
1,001-3,300	285,528	2,744,074	1,574,139	682,460	5,286,202
3,301-10,000	2,426,840	3,382,879	2,676,109	1,260,792	9,746,619
10,001-50,000	7,950,684	6,542,558	5,499,984	3,614,884	23,608,109
50,001-100,000	4,263,166	3,094,325	2,997,895	1,691,771	12,047,156
100,001-1,000,000	14,012,813	4,706,307	6,563,039	4,766,986	30,049,146
>1,000,000	7,646,197	1,476,881	1,865,054	2,783,284	13,771,417
Total	**36,767,246**	**23,696,316**	**22,179,702**	**15,235,232**	**97,878,496**

Notes: Category 1: systems have any lead known content service lines; Category 2: systems have all non-lead service lines; Category 3: systems have all unknown service lines; Category 4: systems have a mix of non-lead and unknown service lines. Unreported service lines are grouped with unknown service lines.
Source:
Results of the DWINSA LSL Allocation Model system weights used as an approximation for service line weights. See derivation file "Service Line Characterization using DWINSA_Final.xlsx", worksheet "SL by Category."

Step 3: Use the service line characterizations from Exhibit 3-11 and Exhibit 3-12 and simplifying assumptions to estimate the distribution of known lead content, non-lead, and unknown service lines in Categories 1 through 4. The EPA's approach is described below.

[45] Fact Sheet: 7th Drinking Water Infrastructure Needs Survey and Assessment, April 2023. Available online at https://www.epa.gov/system/files/documents/2023-04/Final_DWINSA%20Public%20Factsheet%204.4.23.pdf

Exhibit 3-13 includes a set of three tables that provide the number of service lines for each of the nine size categories for Categories 1 through 4 with the number of lead content in the first table; the number of non-lead service lines in the second table; and the number of unknowns in the third table. Note that the total number of known lead content (5.1 million), non-lead (54.5 million), and unknown (38.3 million) service lines in the last column, last row of each table in Exhibit 3-13 matches the total for each service line type in Exhibit 3-11.

The EPA used the following assumptions to determine the number of each type of service line by category:

1. Assign all known lead content service lines (5.1 million) to Category 1 based on system category definitions.

2. Of the total 54.5 million known non-lead service lines (as presented in Column B in Exhibit 3-11), assign 23.7 million to Category 2 since all service lines in Category 2 are non-lead (see the total non-lead service lines for Category 2 in Exhibit 3-12).

3. Of the total service lines in Category 4 systems (15.2 million), make a simplifying assumption that two-thirds are non-lead. The EPA chose this ratio based on the distribution of unknown and non-lead service lines in the original DWINSA survey and the one-time update in the absence of detailed estimates for each size category. The EPA recognizes this is a simplifying assumption that may introduce uncertainty; however, the EPA does not calculate national costs independently for Categories 1 through 4. These categories were used for modeling purposes only. The total number of non-lead service lines assigned to category 4 using this approach is approximately 10.2 million.

4. Assign the remaining non-lead service lines (54.5– 23.7 – 10.2 = 20.6 million) to Category 1.

5. Of the total 38.3 million unknown service lines (see Column C in Exhibit 3-11), assign 22.2 million to Category 3 since all 22.2 million service lines in Category 3 are unknown by definition (see Exhibit 3-12).

6. Assume that the other third of the service lines in Category 4 systems are unknown. This represents the remaining service lines in Category 4, which is equal to the total of 15.2 million service lines (see Category (4) Exhibit 3-12) minus 10.2 million assigned non-lead service lines from Step 3 above, for a total of 15.2 – 10.2 = 5.0 million unknown service lines in Category 4.

7. Assign the remaining unknown service lines (38.3 – 22.2– 5.0 = 11.1 million) to Category 1.

Exhibit 3-13: Allocation of Known Lead Content, Non-Lead, and Unknown Service Lines to Categories 1 through 4

Table 1 Known Lead Content Service Lines

System Size (Population Served)	Number of *Lead Content* Service Lines per System Category				Total Lead Content Service Lines
	Any Lead Content (1)	All Non-Lead (2)	All Unknown (3)	Non-lead and Unknown (4)	
≤100	3,143	-	-	-	3,143
101-500	13,824	-	-	-	13,824
501-1,000	13,525	-	-	-	13,525
1,001-3,300	47,831	-	-	-	47,831
3,301-10,000	566,386	-	-	-	566,386
10,001-50,000	1,513,830	-	-	-	1,513,830
50,001-100,000	679,129	-	-	-	679,129
100,001-1,000,000	1,591,955	-	-	-	1,591,955
>1,000,000	683,352	-	-	-	683,352
Total	**5,112,975**	**-**	**-**	**-**	**5,112,975**

Table 2 Non Lead Service Lines

System Size (Population Served	Number of *Non-Lead* Service Lines per System Category				Total Non-Lead Service Lines
	Any Lead Content (1)	All Non-Lead (2)	All Unknown (3)	Non-lead and Unknown (4)	
≤100	12,692	180,285	-	30,041	223,019
101-500	55,835	793,085	-	132,153	981,072
501-1,000	54,626	775,922	-	129,293	959,841
1,001-3,300	193,188	2,744,074	-	457,248	3,394,511
3,301-10,000	798,502	3,382,879	-	844,731	5,026,111
10,001-50,000	3,362,763	6,542,558	-	2,421,972	12,327,293
50,001-100,000	2,428,569	3,094,325	-	1,133,486	6,656,380
100,001-1,000,000	9,052,300	4,706,307	-	3,193,881	16,952,488
>1,000,000	4,623,362	1,476,881	-	1,864,801	7,965,044
Total	**20,581,838**	**23,696,316**	**-**	**10,207,605**	**54,485,759**

Table 3 Unknown Service Lines

System Size (Population Served	Number of *Unknown* Service Lines per System Category				Total Unknown Service Lines
	Any Lead Content (1)	All Non-Lead (2)	All Unknown (3)	Non-lead and Unknown (4)	
≤100	2,924	-	103,421	14,796	121,141
101-500	12,864	-	454,953	65,090	532,907
501-1,000	12,585	-	445,108	63,682	521,375
1,001-3,300	44,509	-	1,574,139	225,212	1,843,860
3,301-10,000	1,061,952	-	2,676,109	416,061	4,154,122
10,001-50,000	3,074,090	-	5,499,984	1,192,912	9,766,986
50,001-100,000	1,155,468	-	2,997,895	558,284	4,711,647

System Size (Population Served	Number of *Unknown* Service Lines per System Category				Total Unknown Service Lines
	Any Lead Content (1)	All Non-Lead (2)	All Unknown (3)	Non-lead and Unknown (4)	
100,001-1,000,000	3,368,558	-	6,563,039	1,573,105	11,504,703
>1,000,000	2,339,483	-	1,865,054	918,484	5,123,021
Total	**11,072,433**	**-**	**22,179,702**	**5,027,626**	**38,279,762**

Source: DWINSA LSL Allocation Model. See the derivation file, "Service Line Characterization using DWINSA_Final.xlsx", worksheet "SL by Category."

Step 4: Calculate the percentages needed to characterize service line material type for the SafeWater LCR model by dividing the known lead content, non-lead, and unknown service lines counts per system type and size category in Exhibit 3-13 by the total service lines by system type and size category in Exhibit 3-12. For example, for systems serving 1,001 – 3,300 in Category 1, the percent of lines that are lead content is calculated as 47,831 (from Exhibit 3-13, Table 1) divided by 285,528 (from Exhibit 3-12) equals 16.8 percent. The results of this step for all SafeWater LCR variables are combined with the results of Steps 5 and 6 below.

Step 5: Estimate the proportion of unknown service lines that contain lead. Many survey respondents reported that they either did not know the material of their service lines or left the section blank (*i.e.*, the "unreported" responses). For the DWSRF allocation, the EPA explored different methods to estimate the proportion of these unknown and unreported service lines that might contain lead.

In the absence of more detailed information, the EPA assumed that for each State, the proportion of unknown and unreported service lines with potential lead content is equal to the percent of all known service lines in that State (lead + non-lead) that contain lead. The EPA estimated the number of lead content service lines in each State and calculated the ratio of lead content service lines to the total number known service lines. This ratio was then applied to the number of unknown service lines in each State to project the number lead content service lines. The EPA then distributed these estimated lead content service lines across different system size categories based on the percent of service lines in each size category within each State. The counts were aggregated to get the projected number lead content service lines in each size category nationally. This national number was divided by the total number of unknown service lines in each size category to find the projected percentage of lead content service lines. Results are shown in Exhibit 3-11, Column E. The EPA recognizes the uncertainty in this assumption and that the actual number of lead content service lines among the unknowns and unreported may be higher or lower.

Step 6: Use the results from Steps 4 and 5 (in the form of percents) and the number of service connections from the SDWIS/Fed 4th quarter 2020 data to calculate the total number of potential lead content service lines per system category and size strata.

Although the DWINSA LSL Allocation Model is based on the second quarter of 2019 SDWIS/Fed population data, adjusted based on survey responses, this EA uses SDWIS 2020 4th quarter freeze data consistently across all analyses. For the purposes of modeling systems in the SafeWater LCR model, the EPA evaluated the 2020 connection data compared to the minimum population for PWSs and the

relationship between connections and populations (*i.e.*, population per number of connections). The EPA adjusted the SDWIS/Fed 4th quarter 2020 connection data for systems serving 100 or fewer people as follows.

- Systems with listed populations less than 25 had their populations revised to 25 to conform to the definition of a PWS under SDWA.
- If the number of people per connection (population/number of connections) was less than one or greater than five, then the number of connections for that system was adjusted to be the population of that system divided by the mean number of connections per person for its size and source water category. This data cleaning step is consistent with the approach used under the 2021 LCRR analysis.

The total number of connections per size category and CCT status derived from the SDWIS/Fed 4th quarter 2020 data are shown in Exhibit 3-14.

Exhibit 3-14: Total Number of Service Lines by System Size and CCT Status based on SDWIS/Fed 4th Quarter 2020 Data

System Size (Population Served)	Total Number of Connections			Number of CWSs	Average Number of Connections per CWS
	with CCT	without CCT	Total		
	A	B	C = A+B	D	E = C/D
≤100	37,942	277,850	315,792	11,732	27
101-500	358,968	1,247,941	1,606,909	15,084	107
501-1,000	519,552	1,098,346	1,617,898	5,330	304
1,001-3,300	2,660,788	3,382,584	6,043,372	7,967	759
3,301-10,000	6,198,589	4,984,027	11,182,616	5,026	2,225
10,001-50,000	18,022,965	8,562,958	26,585,923	3,374	7,880
50,001-100,000	13,030,588	298,917	13,329,505	571	23,344
100,001-1,000,000	32,908,364	245,317	33,153,681	421	78,750
>1,000,000	16,084,234	0	16,084,234	24	670,176

Source: File "Service Line Characterization using DWINSA_Final.xlsx," worksheet "Systems and Connections."
Note: Based on connection data from SDWIS 4th quarter 2020 frozen dataset, current through December 31, 2020. Adjusted for systems serving ≤ 100 people if the reported population was less than 25 or if the number of people per connection was less than 1 or greater than five.

Exhibit 3-15 through Exhibit 3-17 summarize the results of Steps 4 through 6, showing the known and projected lead content service lines (percent and number) for Categories 1, 3, and 4 and the corresponding SafeWater LCR variable names. Exhibit 3-18 shows the total known and projected lead content service lines per category and the national total estimate of 9.8 million potential lead content lines.

Exhibit 3-15: Known and Projected Lead Content Service Lines in Category 1 Systems

System Size (population served)	SDWIS 2020, Adjusted Connection Data		Percent of CWSs in Category 1	Lead Content SL in Category 1 Systems			Projected Lead Content SL in Category 1 Systems			
	Total Number of CWSs	Average No. of SL / System		Percent SL that are Known (i.e., lead or non-lead)	Percent of Known SL that are Lead Content	Number of SL that are Lead Content in Category 1 Systems	Percent SL that are Unknown	Percent of Unknown SL Projected to be Lead Content	Number of Projected Lead Content SL in Category 1 Systems	Total Known and Projected Lead Content SL in Category 1 Systems
			p_lsl	*perc_lsl_known*	*perc_lsl_known_lead*			*perc_unknown_lead*		
	A	B	C	D	E	F = A*B*C*D*E	G = 1 - D	H	I = A*B*C*G*H	J = F+I
≤100	11,732	27	1.9%	84.4%	19.8%	992	15.6%	1.4%	13	1,005
101-500	15,084	107	1.9%	84.4%	19.8%	5,046	15.6%	1.4%	65	5,112
501-1,000	5,330	304	1.9%	84.4%	19.8%	5,081	15.6%	1.4%	66	5,147
1,001-3,300	7,967	759	1.9%	84.4%	19.8%	18,979	15.6%	1.4%	245	19,224
3,301-10,000	5,026	2,225	20.6%	56.2%	41.5%	537,272	43.8%	11.2%	113,057	650,329
10,001-50,000	3,374	7,880	29.8%	61.3%	31.0%	1,508,873	38.7%	12.6%	386,474	1,895,347
50,001-100,000	571	23,344	35.7%	72.9%	21.9%	757,931	27.1%	12.5%	160,810	918,741
100,001-1,000,000	421	78,750	34.3%	76.0%	15.0%	1,293,766	24.0%	11.5%	313,603	1,607,369
>1M	24	670,176	43.1%	69.4%	12.9%	620,086	30.6%	10.8%	228,891	848,977
Total	**49,529**					**4,748,026**			**1,203,224**	**5,951,250**

Source: 7th DWINSA, Derivation file “Service Line Characterization using DWINSA_Final.xlsx”, worksheet “Category 1 Characterization.”

Notes:

Category 1 includes systems with any known lead content. SL = service line; CWS = Community Water System.

A, B: Exhibit 3-14, Columns D and E, respectively.

C: Exhibit 3-10, Column C, combined for systems with and without CCT. Note that this is for Category 1 systems only and represents the percentage of systems rather than the percentage of service lines.

D: Calculated by taking the sum of lead content and non-lead service lines in Category 1 from Exhibit 3-13, Tables 1 and 2, and dividing it by the total service lines in Category 1 from Exhibit 3-12. Calculated separately for each size category. For instance, for systems serving 101-500, total known service lines = 13,824 + 55,835 = 69,659 from Exhibit 3-13, Tables 1 and 2. The total number of service lines in Category 1 for systems serving 101 – 500 from Exhibit 3-12 is 82,523. Divide 69,659 by 82,523 to estimate the percent of all service lines that are known (*i.e.*, lead content or non-lead) = 84 percent.

E: Calculated by taking the number of lead content service lines in Category 1 from Exhibit 3-13, Table 1 and dividing it by the sum of lead content and non-lead content service lines in Category 1 from Exhibit 3-13, Tables 1 and 2. For instance, for systems serving 101 – 500, the number of lead content service lines is 13,824. The total number of known lines is lead plus non-lead, or 13,824 + 55,835 = 69,659. The percent of known lines that are lead content equals 13,824 divided by 69,659 = 20 percent.

H: Exhibit 3-11, Column E.

F, I, and J: Estimated values by row may differ from those calculated by using exhibit inputs-because of independent rounding.

A, F, I, and J: Totals may not add due to independent rounding.

Exhibit 3-16: Projected Lead Content Service Lines in Category 3 Systems

System Size (population served)	SDWIS 2020, Adjusted Connection Data		Percent of Systems in Category 3	Percent of Unknown SL Projected to be Lead Content	Number of Projected Lead Content SLs in Category 3 Systems
	Total Number of CWSs	Average No. of SL / System	*p_lsl_unknown*	*perc_unknown_lead*	
	A	B	C	D	E=A*B*C*D
≤100	11,732	27	41.4%	1.4%	1,817
101-500	15,084	107	41.4%	1.4%	9,244
501-1,000	5,330	304	41.4%	1.4%	9,307
1,001-3300	7,967	759	41.4%	1.4%	34,764
3,301-10,000	5,026	2,225	32.9%	11.2%	413,360
10,001-50,000	3,374	7,880	26.5%	12.6%	890,095
50,000-100,000	571	23,344	25.1%	12.5%	417,435
100,000-1,000,000	421	78,750	28.3%	11.5%	1,075,833
>1,000,000	24	670,176	25.5%	10.8%	442,055
Total	**49,529**				**3,293,910**

Acronyms: CWS = community water system; SL = service line.

Notes:

General: Category 3 is systems with only all unknown service lines.

A, B: Exhibit 3-14, Columns D and E, respectively.

C: Exhibit 3-10, Column E, combined for with and without CCT. Note that this is for Category 3 systems only and represents the percentage of systems rather than the percentage of service lines.

D: Exhibit 3-11, Column E.

E: Estimated values by row may differ from those calculated by using exhibit inputs-because of independent rounding.

A and E: Totals may not add due to independent rounding.

Exhibit 3-17: Projected Lead Content Service Lines in Category 4 Systems

System Size (Population Served)	SDWIS 2020, Adjusted Connection Data		Percent of Systems in Category 4	Percent of SL that are Unknown in Category 4	Estimated Number of Unknown Service Lines in Category 4 Systems	Percent of Unknown Service Lines that are Projected to be Lead Content	Number of Projected Lead Content SL in Category 4 Systems
	Total Number of CWSs	Average No. of SL / System	*p_lsl_nolead_unknown*	*perc_lsl_nolead_unknown_unknown*		*perc_unknown_lead*	
	A	B	C	D	E = A*B*C*D	F	G = F*E
≤100	11,732	27	4.9%	33%	5,128	1.4%	71
101-500	15,084	107	4.9%	33%	26,093	1.4%	363
501-1,000	5,330	304	4.9%	33%	26,271	1.4%	365
1,001-3,300	7,967	759	4.9%	33%	98,131	1.4%	1,364
3,301-10,000	5,026	2,225	11.4%	33%	421,262	11.2%	47,278
10,001-50,000	3,374	7,880	14.9%	33%	1,305,766	12.6%	164,700
50,001-100,000	571	23,344	15.0%	33%	660,065	12.5%	82,312
100,001-1,000,000	421	78,750	13.7%	33%	1,494,393	11.5%	171,189
>1M	24	670,176	13.7%	33%	728,521	10.8%	78,550
Total	**49,529**				**4,765,630**		**546,192**

Acronyms: CWS = community water system; SL = service line.

Notes:

General: Category 4 is systems with a mix of non-lead and unknown service lines.

A, B: Exhibit 3-14, Columns D and E, respectively.

C: Exhibit 3-10, Column F, combined for with and without CCT. Note that this is for Category 4 systems only and represents the percentage of systems rather than the percentage of service lines.

D: Calculated by taking the number of unknown service lines in Category 4 from Exhibit 3-13, Table 3 and dividing it by the total number of service lines in Category 4 from Exhibit 3-12. Calculated separately for each system size category. For instance, for systems serving 501 – 1,000, the unknown service lines are 63,682. The total number of service lines for Category 4 systems serving 501 – 1000 from Exhibit 3-12 is 192,974. Divide 63,682 by 192,974 to estimate the percent of service lines that are unknown = 33%. Note that in Step 3 of the analysis, the EPA made a simplifying assumption for the percent of service lines that are unknown for this category. The remaining unknown service lines were allocated to Category 1.

F: Exhibit 3-11, Column E.

E and G: Estimated values by row may differ from those calculated by using exhibit inputs-because of independent rounding.
A, E, and G: Totals may not add due to independent rounding.

Exhibit 3-18: Total Number of Known and Projected Lead Content Service Lines by Category

System Size (Population Served)	Category 1		Category 2	Category 3	Category 4	Total
	Number of Known Lead Content SLs	Number of Projected Lead Content SLs	Number of Known or Projected Lead Content SL	Number of Projected Lead Content SLs	Number of Projected Lead Content SLs	
	A	B	C	D	E	F = SumA:E
≤100	992	13	0	1,817	71	2,893
101-500	5,046	65	0	9,244	363	14,718
501-1,000	5,081	66	0	9,307	365	14,819
1,001-3,300	18,979	245	0	34,764	1,364	55,352
3,301-10,000	537,272	113,057	0	413,360	47,278	1,110,967
10,001-50,000	1,508,873	386,474	0	890,095	164,700	2,950,142
50,001-100,000	757,931	160,810	0	417,435	82,312	1,418,488
100,001-1,000,000	1,293,766	313,603	0	1,075,833	171,189	2,854,391
>1M	620,086	228,891	0	442,055	78,550	1,369,582
Total	**4,748,026**	**1,203,224**	**0**	**3,293,910**	**546,192**	**9,791,351**

Acronyms: CWS = community water system; SL = service line.

Notes:

General: Category 1 are systems with any lead content service lines; Category 2 are systems with all non-lead service lines; Category 3 are systems with all unknown service lines, and Category 4 are systems with a mix of non-lead and unknown service lines.

A: Exhibit 3-15, Column F.

B: Exhibit 3-15, Column I.

C: Zero because these systems have all non-lead service lines.

D: Exhibit 3-16, Column E.

E: Exhibit 3-17, Column G.

F: Estimated values by row may differ from those calculated by using exhibit inputs-because of independent rounding.

A, B, D, E, and F: Totals may not add due to independent rounding.

Step 7: Characterize the percent of lead content service lines that are full LSLs, partial LSLs, GRR service lines, lead connectors, and galvanized previously downstream of lead connectors.

As described earlier in this section, the 7th DWINSA collected detailed information on lead content service lines, asking respondents to classify lead content lines as LSLs, lead connectors, GRR service lines, and galvanized previous downstream from lead connectors. The agency used the 7th DWINSA survey results to estimate, by system size strata, the percent of total lead content service lines (known + projected), from Exhibit 3-18 that fall into each of these lead content categories.[46] The EPA made one additional distinction for LSLs: For the purposes of this analysis, the EPA estimated that 80 percent of LSLs are full service lines and 20 percent are partial service lines, meaning that part of the service line (e.g., either the service line on the system-side property or the customer side property) had been replaced. This estimate is consistent with the approach used in the Final 2021 LCRR EA (USEPA, 2020a) as summarized below. The percentages including the estimated 80/20 split between full and partial LSLs are presented in Exhibit 3-19.

The EPA recognized that many systems have been replacing LSLs as a component of infrastructure improvement programs The EPA assumed a one percent replacement rate from the promulgation of the original LCR in 1991 to 2020 when the LCRR became final or 29 years. Based on a survey by Black & Veatch (2004), the EPA assumed that approximately 72 percent of those replacements were partial LSLRs. Thus, the EPA estimated that approximately 20 percent (29 years * 1 percent LSLR per year * 72 percent of replacements are partials) of LSLs have already been partially replaced on the utility side prior to the 2021 LCRR (USEPA, 2020a).

For the final LCRI, the compliance date is projected to be 2027 which may result in additional partial replacements between 2020 through 2027. However, the EPA has been strongly encouraging full replacements, and many funding sources have become available for customer side replacements (for a list of funding sources, see EPA's website: https://www.epa.gov/ground-water-and-drinking-water/funding-lead-service-line-replacement). In the absence of additional data on partial vs. full replacements, the EPA continues to assume an estimated 20 percent of LSLs are partial LSLs for this EA.

The EPA applied these percentages to the adjusted SDWIS/Fed 4th quarter 2020 data estimate of lead content service lines for each system size category, both known and projected, to determine the number of each type of lead content service line in each size category. The results of this characterization are shown in Exhibit 3-19 below. Note that the counts of service lines include known lead content service lines from Category 1, and projected lead content service lines in Categories 1, 3, and 4.

[46] As previously noted in this section, the DWINSA one-time update used combined categories for galvanized lines. To estimate the percent of galvanized previously downstream of lead connectors separately from GRR, the EPA used the proportions from the original 7th DWINSA dataset.

Exhibit 3-19: Characterization of Lead Content Service Lines in CWSs

System Size (Population Served)	Total Known and Projected Lead Service Lines	Full LSLs		Partial LSLs		Lead Connectors		GRR		Galvanized Previously Downstream of Connectors	
		Percent *pp_lsl_full*	Number	Percent *pp_lsl_partial*	Number	Percent *pp_lsl_connector*	Number	Percent *pp_lsl_grr*	Number	Percent *pp_lsl_gpdlc*	Number
	A	B	C = A*B	D	E = A*D	F	G = A*F	H	I = A*H	J	K = A*J
≤100	2,893	65.3%	1,888	16.3%	472	10.5%	304	0.6%	17	7.3%	211
101-500	14,718	65.3%	9,607	16.3%	2,402	10.5%	1,549	0.6%	89	7.3%	1,071
501-1,000	14,819	65.3%	9,673	16.3%	2,418	10.5%	1,559	0.6%	90	7.3%	1,079
1,001-3,300	55,352	65.3%	36,131	16.3%	9,033	10.5%	5,824	0.6%	335	7.3%	4,030
3,301-10,000	1,110,967	28.4%	315,450	7.1%	78,863	49.5%	549,574	5.7%	63,457	9.3%	103,623
10,001-50,000	2,950,142	43.3%	1,276,476	10.8%	319,119	25.4%	750,192	8.4%	247,567	12.1%	356,789
50,001-100,000	1,418,488	47.6%	675,478	11.9%	168,869	26.6%	376,687	6.3%	89,568	7.6%	107,886
100,001-1,000,000	2,854,391	62.5%	1,782,775	15.6%	445,694	12.2%	348,571	4.8%	137,612	4.9%	139,740
>1M	1,369,582	69.1%	946,236	17.3%	236,559	11.7%	159,983	0.8%	11,227	1.1%	15,577
Total	9,791,351		5,053,714		1,263,429		2,194,242		549,962		730,005

Notes: See Exhibit 3-8 for details on which categories reported in the 7th DWINSA were included in each service material category shown here. Totals may not add due to independent rounding.

Source:

B, D, F, H, and J: Generated using the DWINSA LSL Allocation Model. Assumes that 20 percent of all LSLs are partial based on infrastructure replacement rate of 1 percent per year between 1991 when the LCR became finalized and 2020. The relationship between GRR and galvanized previously downstream of a lead connector was determined using the original 7th DWINSA survey dataset because the categories were combined in the one-time update.

C, E, G, I, and K: Estimated values by row may differ from those calculated by using exhibit inputs-because of independent rounding.

A, C, E, G, I, and K: Totals may not add due to independent rounding.

For purposes of this EA, the EPA estimates that there are approximately 9.8 million lead content service lines (*i.e.*, LSLs, GRR service line, lead connectors, and galvanized previously downstream of lead connectors). As previously explained, the LCRI focuses on mandatory replacement of lead and GRR service lines. This rule requires the replacement of lead connectors when encountered during normal operations like main replacement and does not require replacement of galvanized lines downstream of lead connectors. Therefore, using the values in Exhibit 3-19 the EPA estimates that the total number of lead and GRR service lines that will require replacement under the LCRI is approximately 6.9 million (5.1 million full LSLs, 1.3 million partial LSLs, and 0.5 million GRR service lines).

The EPA recognizes that the approach for estimating the total number of lead content service lines for this EA is slightly different than the approach used to estimate the total number of lead content service lines for the DWINSA Allocation Model, and that these differences produce a different estimated number of total lead content service lines. Exhibit 3-20 compares the total number of known and potential lead content service lines from this Final LCRI EA and the 7th DWINSA Fact Sheet. The totals are higher for this EA at 9.8 million lead content service lines compared to the DWINSA Fact Sheet at 9.0 million lead content service lines (USEPA, 2024a). The exhibit also describes assumptions for different elements of the analysis, noting where they are the same or different. The largest difference in the two datasets is the total connection data as reported in SDWIS/Fed, which is multiplied by percentages of known and potential lead content to produce total service line counts. This EA used values from SDWIS/Fed 4th quarter 2020 frozen dataset, adjusted upward using decision rules as described in Step 6 above. The 7th DWINSA Fact Sheet value is based on 2nd quarter 2019 SDWIS/Fed data without similar adjustments but updated based on survey responses. Note that the percent of systems with lead content service lines and percent of connections that are lead content is similar between this EA and the DWINSA Allocation Model.

Exhibit 3-20: Similarities and Differences in Service Line Material Data Analysis for the Final LCRI Economic Analysis and the DWINSA LSL Allocation Model

Element of the Service Line Material Analysis	Final LCRI Economic Analysis	DWINSA LSL Allocation Model[1]
Total Number of Known and Potential Lead Content Service Lines	9.8 million	9.0 million
Source Data	Uses responses from both the 7th DWINSA and one-time update.	Same.
Types of Systems Included	Includes CWSs from all 50 States, DC, PR, and the territories. Service line material data from ANV and AI systems were not included.	Same.
Use of Sampling Weights	Uses system sampling weights to estimate national totals.	Uses system sampling weights to estimate State totals and

Element of the Service Line Material Analysis	**Final LCRI Economic Analysis**	**DWINSA LSL Allocation Model[1]**
		adds them together for national totals.
Unreported vs Unknown	Groups unknown and unreported together.	Maintains unknown and unreported as separate categories.
Methodology for Estimating the Number of Service Lines by Material Type	Used State ratios to estimate the proportion of service lines that are known lead content, non-lead and unknown (which includes unreported) by 9 system size categories. Used decision rules to estimate the proportion of lead content, non-lead, and unknown in 4 system categories.	Uses State ratios to estimate the proportion of service lines that are known lead content, non-lead, unknown, and unreported for all system size categories.
Projections	Projections of unknown and unreported service lines that are found to be lead content are based on the percent of known service lines (both lead and non-lead) that are known lead-content.	Same.
Classification of Lead Content Service Line Material	Uses five categories of lead content service lines: • Full LSL • Partial LSL • GRR Service Lines • Lead Connectors • Galvanized previously downstream of lead connector	Groups all lead content service lines.
Use of SDWIS/Fed data	Uses 4th quarter 2020 SDWIS/Fed data with adjustments for service connections for systems serving < 100 people.	Uses 2nd quarter 2019 data from SDWIS/Fed, updated where appropriate with system responses to the 7th DWINSA survey

Acronyms: CWS = community water system; DC = District of Columbia, PR = Puerto Rico, ANV = Alaska Native Village, AI = American Indian, LSL = lead service line, SDWIS = Safe Drinking Water Information System.
Note: [1] See USEPA 2023d for a description of the model used to estimate the number of lead service lines.

3.3.4.1.3 Discussion of Data Limitations and Uncertainty

There are analytical uncertainties associated with the use of the 7th DWINSA to characterize systems containing lead content service lines and the proportions of service lines in those systems that are lead. While efforts were made to ensure that the sample of systems surveyed was representative of the population of all systems, such as the assignment of system weights and their incorporation into the analysis of survey results, the representativeness of these results may have been diminished due to inaccurate and non-responses to the survey. For example, systems may not know the material make-up of the service lines in their service area. Furthermore, the presence or lack of lead lines may affect a systems' willingness to respond to the survey. The EPA mitigated the potential error associated with these survey responses by letting systems include lines of unknown material, comparing responses to the total connections reported in SDWIS/Fed, and providing the states with the opportunity to review the responses.

To estimate national costs and benefits of the final LCRI, the EPA made several assumptions regarding the unknown and unreported service line materials in the 7th DWINSA results:

- The proportion of unknown service lines that are lead is the same as the proportion of known service lines that are lead. This estimate was based on the proportion of systems with at least one known lead content service line – derived from the results of the survey – and the number of lead content service lines nationally – projected from the results of the survey using State ratios and connection data from SDWIS/Fed.
- The percent of unknown service lines that are found to be lead is the same regardless of system category.
- All systems with unknown content service lines are likely to have at least one LSL.

These assumptions and the following additional assumptions could underestimate or overestimate the costs and benefits of the final LCRI:

- The EPA made simplifying assumptions about the proportion of unknown and non-lead service lines in Categories 1 (systems with any lead content) and 4 (systems with non-lead and unknowns) and the percent of lead service lines that are partial as opposed to full.
- There is uncertainty associated with using connection data from the SDWIS/Fed 4th quarter data freeze to apply to DWINSA-derived percentages to estimate the total lead content service lines (known + potential).

3.3.4.2 LSL Inventory for NTNCWSs

Information comparable to the DWINSA LSL Allocation Model for CWSs described in Section 3.3.4.1 has not been collected on the occurrence of lead content service lines in NTNCWSs[47]. Therefore, the EPA used the approach from the Final 2021 LCRR EA (USEPA, 2020a) to estimate the occurrence of LSLs in

[47] The DWINSA LSL Allocation Model included a limited number of responses for NTNCWSs, but the data were insufficient to draw conclusions regarding the extent of lead service lines for NTNCWSs.

NTNCWSs. Note that the EPA assumes that the NTNCWSs have no stand-alone lead connectors and no GRR service lines since NTNCWSs are unlikely to replace only the upstream portion of an LSL and leave a galvanized service line in place, because the full service line is likely on the property of the system, and galvanized lines have a high failure rate given age and disturbance like that produced by removing a section of LSL.[48]

This section outlines the EPA's approach for estimating the number of NTNCWSs with LSLs (Section 3.3.4.2.1) and number of LSLs (Section 3.3.4.2.2). A discussion of data limitations and uncertainties is provided in Section 3.3.4.2.3.

3.3.4.2.1 Number of NTNCWSs with LSLs

In August 2017, the EPA disseminated a questionnaire to nine States regarding the burden and cost associated with the National Drinking Water Advisory Council's (NDWAC's) recommendation to require all systems to develop a comprehensive LSL inventory and to expand the definition of an LSL to include lead connectors even if the service line is not made of lead.[49] The questionnaire included questions on the estimated number or percentage of NTNCWSs with one or more LSLs and the total number of LSLs in NTNCWSs. States were selected for geographical diversity, known occurrence of LSLs in CWSs, and active LSLR projects. The EPA received responses from seven States. Four States did not provide any estimates. The remaining three States provided estimates ranging from zero to five percent. Exhibit 3-21 below provides a summary of the seven States' responses.

Exhibit 3-21: Summary of State Responses Regarding the Percentage of NTNCWSs with LSLs

Response	Number of States with this Response
Unknown/Information not readily available	3
Unknown but expected to be very low	1
Unknown but expected to be 0	1
Estimated to be 0 – 5 percent	1
Estimated to be <5 percent (gross estimate)	1
Estimated to be ≥5 percent	0
Total	**7**

Source: A copy of the questionnaire and each State's response is available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Due to the uncertainty of the responses and the respondents being in States with known LSLs in CWSs, the EPA used the midpoint of the range reported by States to estimate the number of NTNCWSs that had LSLs. Specifically, the EPA assumed 2.5 percent (corresponds to SafeWater LCR model data variable, *p_lsl*) or 435 NTNCWSs have LSLs**.** The EPA further assumed that systems without CCT are less likely to have LSLs because they would have installed CCT if they had sustained lead ALEs. Thus, the EPA assumed all 435 NTNCWSs with LSLs are those with CCT. Exhibit 3-22 indicates the estimated number of NTNCWSs with and without LSLs for systems with and without CCT.

[48] Florida Department of State (2010). *Rule: 25-30.140*. Florida Administrative Code & Administrative Register. Retrieved July 24, 2023, from https://www.flrules.org/gateway/ruleNo.asp?id=25-30.140
[49] A copy of the questionnaire is available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Exhibit 3-22: Estimated Number of NTNCWSs With and Without LSLs by CCT Status

System Size	Number of NTNCWSs by CCT Status			Estimated Number with LSLs by CCT Status		Estimated Number without LSLs by CCT Status	
	With CCT	No CCT	Total	With CCT	No CCT	With CCT	No CCT
	A	B	C = A+B	D = C*0.025 p_lsl	E = 0	F = A-D	G = B-E
≤100	729	7,659	8,388	210	0	519	7,659
101–500	869	5,511	6,380	160	0	710	5,511
501–1,000	277	1,301	1,578	39	0	238	1,301
1,001–3,300	188	683	871	22	0	166	683
3,301–10,000	34	128	162	4	0	30	128
10,001–50,000	5	32	37	1	0	4	32
50,001–100,000	1	0	1	0	0	1	0
100,001–1M	1	0	1	0	0	1	0
> 1M	0	0	0	0	0		
Total	**2,104**	**15,314**	**17,418**	**435**	**0**	1,669	15,314

Notes:

General:

1. Only systems with CCT are assumed to have LSLs. No NTNCWSs serve more than 1 million people, and the EPA estimates that the two NTNCWSs serving 50,001 – 1 million which are airports do not have LSLs
2. Values by size category may not equal total values do to independent rounding.

A, B: Exhibit 3-7.

D, E: Estimate of 2.5 percent based on information from three States regarding the percentage of NTNCWSs in their State with any LSLs (see Exhibit 3-21). As a simplifying assumption, the EPA assumed that all 2.5 percent of NTNCWSs with LSLs are those with existing CCT. Also, the EPA assumed that the two NTNCWSs serving > 50,000 which are large airports and are unlikely to have LSLs and assigned them to the no LSL category.

3.3.4.2.2 Number of LSLs in NTNCWSs

Two States provided an estimate of the number of LSLs in NTNCWSs in response to the August 2017 questionnaire. One estimated the number to be between zero and five. The second estimated between zero and 50 LSLs and noted that the majority of their NTNCWSs (67 percent) have five or fewer connections. Due to the uncertainty of the responses and representativeness of the data, the EPA did not use the responses to the State questionnaire to develop the national number of LSLs in NTNCWSs. Instead, consistent with the 2021 LCRR, the EPA used the following approach.

1. Determine the median number of service connections from SDWIS/Fed for each of the NTNCWS size categories serving one million or fewer people.
2. For systems with LSLs:
    a. Assume 100 percent of service connections are lead when the median number of service connections is 10 or fewer.
    b. Assume NTNCWSs with more than 10 service connections have experienced expansion over time resulting in service lines of different materials. For these systems, the EPA developed a range, with a minimum of 50 percent and a maximum of 100 percent of service lines assumed to be lead.

Exhibit 3-23 provides the estimated total number of LSLs for each system size category. The corresponding SafeWater LCR model data variable used to estimate costs in Chapter 4 is provided in red italics. Note that the minimum is the same as the maximum except for the three size categories that serve populations of 10,001 – 1 million where the median number of service connections is above 10. As previously stated, the EPA assumes that LSLs in NTNCWSs are limited to the subset of NTNCWSs with CCT.

Exhibit 3-23: Number of LSLs in NTNCWSs with CCT by Size Category

System Size Category	Number of Systems with LSLs (assumes 2.5%)	Median Number of Service Connections	Estimated Percent of Service Connections that Are LSLs		Total Estimated Number of LSLs per Size Category	
			perc_lsl_known			
			Minimum	Maximum	Minimum	Maximum
	A	B	C	D	E=A*B*C	F=A*B*D
≤100	210	1	100%	100%	210	210
101–500	160	1	100%	100%	160	160
501–1,000	39	1	100%	100%	39	39
1,001–3,300	22	2	100%	100%	44	44
3,301–10,000	4	7	100%	100%	28	28
10,001–50,000	1	13	50%	100%	6	12
50,001-100,000						
100,001-1,000,000						
>1,000,000						

System Size Category	Number of Systems with LSLs (assumes 2.5%)	Median Number of Service Connections	Estimated Percent of Service Connections that Are LSLs		Total Estimated Number of LSLs per Size Category	
			perc_lsl_known			
			Minimum	**Maximum**	**Minimum**	**Maximum**
	A	**B**	**C**	**D**	**E=A*B*C**	**F=A*B*D**
Total	**435**				**492**	**504**

Source: "Service Line Characteristics Using DWINSA_Final.xlsx," worksheet, "NTNCWS Lead Service Line Status."
Notes:
General:
1. Only systems with CCT are assumed to have LSLs. No NTNCWSs serve more than 1 million people, and the EPA estimates that the two NTNCWSs serving 50,001 – 1 million which are airports do not have LSLs
2. Values by size category may not equal total values do to independent rounding.
Sources:
A: Exhibit 3-22 Column D.
B: Based on SDWIS/Fed 4th Quarter 2020 connection data.
C, D: For systems with LSLs, the EPA assumed 100 percent of service connections are lead when the median number of service connections was ≤ 10. For NTNCWSs with > 10 service connections, the EPA assumed that service connections have been laid over a period of time and may be composed of different materials. Thus, for these systems, the EPA assumed a minimum of 50 percent and maximum of 100 percent of service lines are lead.

As noted previously, the EPA assumes that all lead content service lines in NTNCWSs are lead pipe. The EPA further assumes that all LSLs are full LSLs because NTNCWSs would not do partial replacement since the entire service line is likely fully on the system's property. The EPA assumes that NTNCWSs have no stand-alone lead connectors and no GRR service lines because they would not have replaced a portion of the service line (the upstream portion) and left the galvanized portion in place.

3.3.4.2.3 Discussion of Data Limitations and Uncertainty

There is a high degree of uncertainty in using the 2.5 midpoint of the range as the estimated percentage of NTNCWSs with LSLs is based on survey results from three States. This uncertainty could result in an under- or overestimate of national costs and benefits of the final LCRI. The EPA assumed that all service lines would be lead in those NTNCWSs with LSLs serving 10,000 or fewer based on the reported median number of service connections in SDWIS/Fed for each size category. This may result in an overestimate of costs and benefits based on the accuracy of the service connection information. However, the impact of these uncertainties is expected to be small due to the low estimated number of NTNCWSs with LSLs.

3.3.4.3 State Service Line Replacement Regulations

In order to estimate future LSLR in the baseline over the period of regulatory analysis (35-years) driven by factors other than potential service line replacement requirements under the final LCRI, the EPA evaluated the extent of State regulations related to the replacement of LSLs. Below is a summary of four existing State regulations:

- Illinois: Requires replacement rates for CWSs based on the number of LSLs, which includes lead connectors, in the system's final inventory and replacement plan. The service line replacement

rate ranges from 2-7 percent annually, with timelines ranging from 15 years to 50 years for completion. The final replacement plan is due April 15, 2027.[50]

- Michigan: Beginning a year after the preliminary inventory was completed, which was due on January 1, 2021, CWSs and NTNCWSs must replace 5 percent of LSLs that include lead connectors and affected galvanized service lines annually, not to exceed 20 years (by 2041). If the system exceeds the lead AL, it must replace 7 percent of LSLs annually.
- New Jersey: CWSs must replace all LSLs, which include galvanized SLs and lead connectors, within 10 years or no later than July 22, 2031 (i.e., annual replacement of at least 10 percent of all known LSLs).
- Rhode Island: CWSs and NTNCWSs must replace all public and private LSLs within 10 years of the June 24, 2023 effective date of the law or by June 24, 2033. This corresponds to an annual replacement of 10 percent of LSLs.

The EPA estimates that these four States have approximately 1.8 million LSLs, which is equivalent to about one-fifth of LSLs in the country. However, only the New Jersey and Rhode Island laws require full replacement of all LSLs by 2034. Therefore, the EPA does not assume that all 1.8 million service lines in these four States would be replaced in the baseline without the 2021 LCRR or the final LCRI. Rather, the EPA estimates that 451,000 service lines would be replaced over the 35-year analysis period because of these State laws.

In addition to these four States, some States or municipalities have voluntary or goal-based programs to replace all LSLs within the next 10 or more years. For example, the preamble section V.B.8 mentions programs in Minnesota to replace all LSLs within 10 years and in Washington to replace all LSLs within 15 years. Because these are not legal requirements, the EPA does not include them in its estimate of the number of LSLs that would be replaced in the baseline.

See Chapter 4, Section 4.3.4.3 for a discussion of how these regulations were considered when estimating service lines replacement costs for the final LCRI EA.

3.3.5 Lead and Copper Tap Levels

The analyses described in this section draw from multiple sources to characterize baseline water quality, including lead and copper levels at customers' taps. Lead 90th percentile data were obtained from SDWIS/Fed, along with information on systems' CCT status. The EPA also used information from 13 States, Region 9 Tribes, and a web search of individual system LSLR programs to identify systems with LSLs. As previously discussed, SDWIS/Fed does not identify which systems have LSLs, only those that are required to initiate LSLR.

The remainder of this section is organized as follows:

[50] For the required replacement rate based on number of lead service lines, see Public Act 0613 102ND GENERAL ASSEMBLY (ilga.gov)

- **Section 3.3.5.1** explains the derivation of the percentage of systems that fall into one of five classifications based on their lead 90th percentile level as a function of LSL and CCT status during the first year of implementation of both the 2021 LCRR and the final LCRI.
- **Section 3.3.5.2** describes the EPA's approach for determining the likelihood a system with an ALE will have two lead ALEs in a five year period, and the likelihood that those systems (with two lead ALEs in a five-year period) will have at least one additional lead ALE within a five-year period (*i.e.*, has multiple ALEs) under the final LCRI.
- **Section 3.3.5.3** provides the likelihood of an individual lead sample being greater than the lead AL of 10 µg/L under the final LCRI.
- **Section 3.3.5.4** provides the likelihood that a system exceeds the copper AL of 1.3 mg/L but not the lead AL.

3.3.5.1 Percent of Systems by Lead 90th Percentile Classification

A system's lead 90th percentile level is an important factor in determining a system's requirements. For the purposes of estimating the incremental costs of the final LCRI relative to the 2021 LCRR (see Chapter 4) and the potential alternative lead AL options (see Chapter 8), the EPA first estimated the proportion of systems that would be placed into the following five lead 90th percentile level classifications under the baseline (2021 LCRR) and the final LCRI:

- Lead 90th percentile (P90) ≤ 5 µg/L
- 5 µg/L < P90 ≤ 10 µg/L
- 10 µg/L < P90 ≤ 12 µg/L
- 12 µg/L < P90 ≤ 15 µg/L
- P90 > 15 µg/L

Sections 3.3.5.1.1 and 3.3.5.1.2 detail the EPA's approach for the 2021 LCRR and final LCRI, respectively.[51] Section 3.3.5.1.3 provides a discussion of the data limitations and uncertainties associated with these estimations.

3.3.5.1.1 Baseline (2021 LCRR)

Under the 2021 LCRR, which is the baseline scenario for the incremental costs analysis of the final LCRI, the EPA modified the sampling protocol for systems with LSLs to require all samples to be collected from

[51] For the 2021 LCRR economic analysis, the EPA used a similar approach to place systems into one of three lead classifications that corresponded to no lead ALE or trigger level exceedance (TLE) (P90 ≤ 10 µg/L), TLE (10 µg/L < P90 ≤ 15 µg/L, and lead ALE (P90> 15 µg/L). However, the EPA used 2016 SDWIS/Fed data for the 2021 LCRR economic analysis. See Chapter 4, Section 4.3.5.1 of the 2021 LCRR economic analysis for a complete description of the EPA's approach.

sites served by LSLs, if available and to require systems to collect a fifth-liter sample at these sites in lieu of a first-liter sample.

The estimated percent of systems in each P90 category is based on SDWIS/Fed historical 90th percentile lead tap sample data from 2012 to 2020. The EPA recognizes that there are uncertainties in predicting the future 90th percentile ranges from historical SDWIS/Fed data. Also, the agency recognizes that these uncertainties could have a significant impact on estimated costs and benefits of the 2021 LCRR. To provide a range of costs and benefits that reflects this uncertainty, the EPA generated both a "low" and "high" estimate for the baseline conditions as detailed in the following four steps:

Step 1 – Identified "Low" and "High" 90th percentile level based on historical data: The EPA reviewed all lead 90th percentile data from 38,348 CWSs with P90 results reported to SDWIS/Fed during 2012 and 2020 and excluded those results that were: 1) negative sample values (Maryland only) and 2) values > 1,500 µg/L, which is 100x higher than the AL of 15 µg/L under the pre-2021 LCR and the 2021 LCRR. From the remaining 38,339 CWSs, the EPA selected the average lead 90th percentile level between 2012 and 2020 for each system as the "low" estimate and the maximum lead 90th percentile for the "high" estimate.

Step 2 – Designated systems by LSL status: Data were grouped according to LSL status for analysis. LSL status for individual systems is not available in SDWIS/Fed. Therefore, the EPA compiled data from numerous State surveys or databases, general web searches conducted during 2018 – 2021 of systems with prior or ongoing LSLR programs, and discussions with some systems serving greater than one million people. The EPA also used responses to the 7th DWINSA (including the one-time update). In the case of conflicting information, the DWINSA LSL determination was prioritized. Exhibit 3-24 summarizes the information from 8,339 systems that were assigned a "yes" / "no" LSL status based on this effort. For additional detail on systems' LSL determination for individual States, see file "DWINSA_StateData_LSL_Status_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Exhibit 3-24 provides the total number of CWSs, the subset with LSLs, the subset with no LSLs, and the percentage of CWSs with known LSL status, for each State and Region 9 tribal systems for which the EPA has some information on the LSL status of its CWSs. In all, the number of systems with known LSL status (8,339) represents approximately 17 percent of the total CWS inventory of 49,529, with information collected from more than 50 percent of States.[52] Column D indicates the percentage of all CWSs for which the EPA has known LSL status information. The fact that the EPA is constrained by the available data that represents 17 percent of total systems results in a high degree of uncertainty around these estimated percentages for systems falling into the ALE or no ALE category. For systems serving > 1M, the EPA obtained system-level LSL estimates from available sources (see the data summary table provided as Exhibit B-2 in Appendix B).

[52] The web searches included some LSL data from 21 States plus Washington, D.C.

Exhibit 3-24: Number of CWSs with LSL Determination Based on State, Tribal, DWINSA Responses, and Web Data[1]

State	Total Number of CWSs in Represented States/R9 Tribes	Number of CWSs with "YES" LSL determination	Number of CWSs with "NO" LSL determination	Percent of All CWSs in Dataset with Known LSL Status
	A	B	C	D = (B+C)/A
EPA Region 9	213	0	213	100%
Alaska	406	1	3	1%
Alabama	509	0	39	8%
Arkansas	682	5	22	4%
American Samoa	18	0	3	17%
Arizona	745	1	18	3%
California	2,878	2	1,44	5%
Colorado	909	10	32	5%
Connecticut	486	11	1	2%
District of Columbia	4	1	0	25%
Delaware	206	3	8	5%
Florida	1,616	57	25	5%
Georgia	1,731	29	32	4%
Hawaii	118	0	118	100%
Iowa	1,082	31	20	5%
Idaho	743	3	20	3%
Illinois	1,760	320	901	69%
Indiana	775	121	205	42%
Kansas	870	13	5	2%
Kentucky	381	8	11	5%
Louisiana	973	10	49	6%
Massachusetts	531	41	27	13%
Maryland	465	26	171	42%
Maine	383	2	5	2%
Michigan	1,380	201	983	86%
Minnesota	965	25	13	4%
Missouri	1,431	43	47	6%
Northern Mariana Islands	36	0	1	3%
Mississippi	1,028	4	25	3%
Montana	757	5	8	2%
North Carolina	2,001	173	1,646	91%
North Dakota	315	6	7	4%
Nebraska	598	10	9	3%
New Hampshire	708	4	13	2%
New Jersey	571	202	90	51%

State	Total Number of CWSs in Represented States/R9 Tribes	Number of CWSs with "YES" LSL determination	Number of CWSs with "NO" LSL determination	Percent of All CWSs in Dataset with Known LSL Status
New Mexico	571	2	5	1%
Nevada	198	0	198	100%
New York	2,294	31	11	2%
Ohio	1,169	183	688	75%
Oklahoma	899	15	28	5%
Oregon	900	0	15	2%
Pennsylvania	1,916	50	16	3%
Puerto Rico	407	0	6	1%
Rhode Island	91	9	1	11%
South Carolina	574	4	13	3%
South Dakota	463	9	13	5%
Tennessee	456	4	19	5%
Texas	4,648	5	61	1%
Utah	502	1	10	2%
Virginia	1,089	4	8	1%
US Virgin Islands	77	0	2	3%
Vermont	411	6	11	4%
Washington	2,291	60	397	20%
Wisconsin	1,040	137	2	13%
West Virginia	433	5	23	6%
Wyoming	315	1	4	2%
TOTAL		**1,894**	**6,445**	

Notes:

[1] The data presented in this exhibit were compiled from numerous State surveys or data bases, web searches of systems with prior or ongoing lead service line replacement programs (LSLR) programs, responses to the 7th DWINSA (including the one-time update), and discussions with some systems serving greater than 1 million people. Determinations of whether CWSs had LSLs within each State were dependent on a hierarchy of these data sources. If the LSL status conflicts between DWINSA and information from the State inventory/web searches, the DWINSA status was used. (For additional detail on systems' LSL determinations, see "DWINSA_StateData_LSL_Status_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.) Note that this exhibit does not show counts of CWSs that reported "unknown" LSL status or for which the data were insufficient for the EPA to determine the system's LSL status. Only those systems whose LSL status was known are described here.

[2] The LSL information for the State of Hawaii was extracted from an April 9, 2016 Associated Press article[53] that stated no drinking water systems in Hawaii have lead pipes.

[3] The LSL information for the State of Nevada was submitted as a public comment on the proposed 2021 LCRR, by the Nevada Division of Environmental Protection, stating that no drinking water systems in Nevada had documented LSLs. Refer to Attachment A that is available in the docket for the 2021 LCRR at EPA-HQ-OW-2022-0801 at www.regulations.gov.

[53] Available at https://www.staradvertiser.com/2016/04/09/breaking-news/hawaii-tap-water-safer-from-lead-than-other-states/.

[4] The web search identified LSL status information for systems from 21 States plus Washington, D.C. For more details, see file "DWINSA_StateData_LSL Status_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

[5] Note that there was overlap with some of the systems with known LSL status in individual States, systems identified through web searches, and those that serve more than 1 million people.

Step 3 – Identified systems with reported lead 90th percentile results and known LSL status: The EPA identified which systems had at least one reported lead 90th percentile value in SDWIS/Fed between 2012 and 2020 and known LSL status. This subset of 6,551 systems[54] was used for the remainder of the analysis described in Step 4. Of the 6,551 systems, 27 percent (1,758 systems) were identified as having LSLs and 73 percent (4,793 systems) were identified as having no LSLs.

Step 4 – Adjust lead 90th percentile results from LSL systems: The EPA adjusted lead 90th percentile results from systems with known LSL status using two multipliers to reflect new sampling requirements under the 2021 LCRR.

1) The first multiplier was used to reflect the requirement for LSL systems to collect all samples from LSL sites where possible, as opposed to the pre-2021 LCR minimum of 50 percent of samples being collected from LSL sites. A lower multiplier (1.20) was used to adjust the "Low" 90th percentile results, and a higher multiplier (1.35) was used to adjust the "High" 90th percentile results.

   The EPA used Slabaugh et al. (2015) to derive these two multipliers. Slabaugh et al. (2015) evaluated LCR compliance data from 17 systems over 72 tap sampling periods, comparing the lead 90th percentile concentrations based on samples collected from all LSLs (either Tier 1 sites—single family structures, or Tier 2 sites—multiple-family residences) to lead 90th percentiles based on samples collected from both LSL and non-lead service line sites. For the lower multiplier, the EPA used the lead 90th percentile median value of 2.5 µg/L obtained for the 1,758 CWSs with LSLs from the set of 6,551 systems with known LSL status. This value, which is based on all reported samples for LSL systems for 2012-2020, is assumed to be representative of LSL systems in general, corresponding to approximately the 9th percentile of the 72 monitoring periods based on the Slabaugh data for samples taken from All Sites in Figure 2.[55] The value for samples taken from Tier 1 and Tier 2 LSL sites only at the 9th percentile value was 3 µg/L. The ratio of these values, 3/2.5= 1.20, was used as the lower multiplier.

   For the higher value, the EPA compared the median 90th percentile for LSL only sites of 8.95 to a median 90th percentile of 6.63 from all monitoring sites.[56] The ratio of the median 90th percentiles for LSL sites compared to all sites was 8.95/6.63 = 1.35. The EPA selected this value (1.35) as a "high" multiplier, meaning that 1.35 was applied to all 90th percentile lead values for LSL systems to reflect the potential impacts of sampling from only LSL sites to predict the initial lead categorization under the 2021 LCRR. This adjustment value may be biased high because the

[54] With the addition of information from the DWINSA one-time supplement, the number of systems with known LSL status increased in the final LCRI EA from the proposed LCRI EA from 6,529 to 6,551.

[55] Percentiles and values taken from Figure 2 of Slabaugh et al. (2015) were read from the graph by WebPlotDigitizer (available at: https://automeris.io/WebPlotDigitizer/).

[56] The median 90th percentile values are based on data presented in Figure 2 of Slabaugh et al. (2015) and were read from the graph by WebPlotDigitizer (available at: https://automeris.io/WebPlotDigitizer/).

median 90th percentile value for the 1,758 systems with LSLs (from among the 6,551 systems used in the EPA's analysis) was only 2.5 µg/L. This 90th percentile value of 2.5 µg/L corresponded with the 9th percentile for the 72 tap sampling periods from the Slabaugh et al. (2015) dataset using all sampling sites. Ideally, this analysis would have been done at the system level, but the EPA did not have access to the dataset of 72 tap sampling periods from the 17 systems. Thus, the EPA could not confirm if the data from the tap sampling periods varied within and among the 17 systems and if system(s) above the AL were overrepresented as nine percent of the sampling periods exceeded the AL.

2) The EPA developed a second multiplier to simulate the expected increase in lead 90th percentile levels resulting from the 2021 LCRR requirement for LSL systems to use the fifth-liter sample results as opposed to the first-liter sample results from each LSL site when calculating lead 90th percentiles. To develop this multiplier, the EPA used paired fifth- and first-liter data[57] from 181 systems in Michigan at LSL locations that were collected in 2019, 2020, and 2021. Only the most recent monitoring period of sampling data was used for systems that had multiple monitoring periods of sampling. The EPA calculated the ratio of the fifth-liter lead 90th percentile concentration to the first-liter lead 90th percentile concentration for each of these 181 systems. Note that there was insufficient data to allow for calculation of separate fifth- to first-liter ratios with respect to CCT status. Overall, the ratios ranged from 0.18 to 25.64 with a mean of 1.41. (Note that reported concentrations below 1 µg/L and non-detects were changed to 1 µg/L).

   For this analysis, the EPA applied the mean ratio of 1.41 to the low and high 90th percentile values reported to SDWIS/Fed for 2012 – 2020 for systems having LSLs to account for LSL systems using the fifth-liter sample results rather than first-liter sample results. The mean ratio was not applied to the non-lead service line systems.

Step 5 – Estimated the Percentage of CWSs in Each Category: Based on Steps 1 through 4, the EPA assigned each CWS one of five lead 90th percentile classifications by the system's LSL status.

Exhibit 3-25 presents the "low" and "high" estimates of the percentage of systems in each lead 90th percentile category by LSL status. The "low estimate" is based on the average 90th percentile lead value reported to SDWIS/Fed from 2012 to 2020; the "high estimate" is based on the highest 90th percentile lead value reported to SDWIS/Fed from 2012 to 2020. Based on the "low estimate," the percentage of systems with LSLs having an ALE, under the 2021 LCRR AL of 15 µg/L, was 9.6 percent as opposed to 2.3 percent for systems without LSLs. For the "high estimate," a much higher percentage of systems with LSLs were classified as having an ALE than those without LSLs, 24.1 percent compared to 4.8 percent. It is important to note that systems without LSLs can have lead sources that can contribute lead to drinking water such as plumbing with lead solder and brass or chrome-plated brass faucets.

Minimal data were available on the LSL status for NTNCWSs. Thus, the above analysis could not be conducted for NTNCWSs. However, an analysis was conducted to evaluate the likelihood of the NTNCWSs' 90th percentile values falling into one of the five lead classifications without the consideration of LSL status. The likelihoods for the NTNCWSs were very similar to those calculated for CWSs. Based on this comparison and the lack of LSL information for NTNCWSs, the EPA assumed the same estimated

[57] Paired data are first- and fifth-liter samples that are collected from the same sampling location during the same sampling event.

percentages for NTNCWSs as those presented in Exhibit 3-25 for CWSs. For additional detail, see file "Initial P90 Categorization_CWS_NTNCWS_LCR_Compare_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Exhibit 3-25: Percent of CWSs by Lead 90th Percentile Classification under the 2021 LCRR

Category	No LSLs	Has LSLs
Low Estimate		
≤ 5 µg/L	88.5%	55.5%
>5 and ≤10 µg/L	7.1%	24.5%
10 µg/L < P90 ≤ 12 µg/L	1.0%	5.3%
12 µg/L < P90 ≤ 15 µg/L	1.0%	5.2%
P90 > 15 µg/L	2.3%	9.6%
High Estimate		
≤ 5 µg/L	79.6%	37.8%
>5 and ≤10 µg/L	11.7%	25.4%
10 µg/L < P90 ≤ 12 µg/L	2.0%	6.8%
12 µg/L < P90 ≤ 15 µg/L	1.9%	6.0%
P90 > 15 µg/L	4.8%	24.1%

Acronyms: CWS = community water system; LCRR= Lead and Copper Rule Revisions; LSL = lead service line; P90 = lead 90th percentile level.

Source: "Initial P90 Categorization_LCRR_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1 Includes CWSs with known LSL status that also reported at least one 90th percentile value to SDWIS between 2012 and 2020.

2 Totals may not add due to independent rounding.

3 Percentages have changed slightly from those presented in the *Economic Analysis for the Proposed Lead and Copper Rule Improvements* (hereafter referred to as the "Proposed LCRI EA") (USEPA, 2023b) because the final rule calculations are based on additional systems with known LSL status from the DWINSA one-time update.

3.3.5.1.2 Final LCRI

The final LCRI reduces the lead AL from 15 µg/L to 10 µg/L. For the purposes of estimating the incremental costs of the final LCRI and potential alterative lead AL options that are presented in Chapter 8, the EPA first estimated the proportion of systems that would be placed into the five lead 90th percentile classifications, which were previously discussed, at the start of the implementation of the final LCRI. The protocol used to generate the "low" and "high" estimate for the final LCRI baseline conditions is identical to the process described in Steps 1-5 of Section 3.3.5.1.1, with one difference in the approach used to adjust lead 90th percentile results from LSL systems. That difference is described below.

As was true for the 2021 LCRR, the EPA adjusted lead 90th percentile results using two multipliers to reflect new sampling requirements under the final LCRI. The first multiplier, used to reflect the requirement for LSL systems to collect all samples from LSL sites where possible, is the same as in

Section 3.3.5.1.1. The lower multiplier used to generate the "Low" estimate was 1.20, and the higher multiplier used to generate the "High" estimate was 1.35.

However, the EPA modified the approach for the estimating the second multiplier to simulate the expected increase on the lead 90th percentile levels if a system with LSLs uses the higher of the paired first- and fifth-liter sample, as required under the final LCRI. To estimate the likelihood that a system having LSLs being placed into one of five lead 90th percentile classifications, the EPA used the same paired fifth- and first-liter data from 181 systems in Michigan at LSL locations that were collected in 2019, 2020, and 2021. Only the most recent monitoring period of sampling data was used for systems that had multiple monitoring periods of sampling. However, for the final LCRI, the EPA used the ratio of the higher of the fifth- and first-liter to the first-liter lead concentrations for each of these 181 systems. Overall, the ratios ranged from 1 to 4.99 with a mean ratio of 1.48. Note that reported concentrations below 1 µg/L and non-detects were changed to 1 µg/L.)

For this analysis, the average ratio of 1.48 was applied to the low and high 90th percentile values for systems having LSLs to account for LSL systems using the higher of the fifth- and first-liter samples rather than first-liter samples. The average ratio was not applied to the non-lead service line systems.

Exhibit 3-26 presents the "low" and "high" estimates of the percentage of systems in each lead 90th percentile category by LSL status. The "low estimate" is based on the average 90th percentile lead value reported to SDWIS/Fed from 2012 to 2020; the "high estimate" is based on the highest 90th percentile lead value reported to SDWIS/Fed from 2012 to 2020. Based on the "low estimate," the percentage of systems with LSLs having an ALE, under the final AL of 10 µg/L, was about 21.0 percent as opposed to 4.4 percent. For the "high estimate," a much higher percentage of systems with LSLs were classified as having an ALE than those without LSLs, 38.9 percent compared to 8.7 percent.[58]

Exhibit 3-26: Percent of CWSs by Lead 90th Percentile Classification under the Final LCRI

Category	No LSLs	Has LSLs
Low Estimate		
No ALE (P90 ≤10 µg/L)	**95.6%**	**79.0%**
≤ 5 µg/L	88.5%	54.4%
>5 and ≤10 µg/L	7.1%	24.6%
ALE (>10 µg/L)	**4.4%**	**21.0%**
10 µg/L < P90 ≤ 12 µg/L	1.0%	5.2%
12 µg/L < P90 ≤ 15 µg/L	1.0%	5.6%
P90 > 15 µg/L	2.3%	10.3%
High Estimate		

[58] Note that under the final LCRI water systems must use the highest sample values in their 90th percentile calculation. This could include samples from non-lead service line sites. The second adjustment does not explicitly model the impact of this rule requirement. However, the EPA uses a low and high adjustment to reflect the uncertainty of the new rule requirements on 90th percentile tap results.

Category	No LSLs	Has LSLs
No ALE (P90 ≤10 µg/L)	**91.3%**	**61.1%**
≤ 5 µg/L	79.6%	37.3%
>5 and ≤10 µg/L	11.7%	23.8%
ALE (>10 µg/L)	**8.7%**	**38.9%**
10 µg/L < P90 ≤ 12 µg/L	2.0%	7.8%
12 µg/L < P90 ≤ 15 µg/L	1.9%	6.0%
P90 > 15 µg/L	4.8%	25.0%

Acronyms: ALE = action level exceedance; CWS = community water system; LCRI = Lead and Copper Rule Improvements; LSL = lead service line; P90 = lead 90th percentile level.
Source: "Initial P90 Categorization_LCRI_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:
1. Gray shaded rows indicate the final LCRI AL of 10 µg/L. Other AL values that the EPA considered are described in greater detail in Chapter 8.
2. Includes CWSs with known LSL status that also reported at least one 90th percentile value to SDWIS between 2012 and 2020.
3. Totals may not add due to independent rounding.
4. Percentages have changed slightly from those presented in the Proposed LCRI EA because the final rule calculations are based on additional systems with known LSL status from the DWINSA one-time update.

3.3.5.1.3 Discussion of Data Limitations and Uncertainty

There are several factors that introduce uncertainty into the initial lead 90th percentile classification as follows:

- Use of historical SDWIS/Fed data to predict future 90th percentile levels.
- Uncertainty in predicting the effects of sampling from 100 percent LSLs.
- Reliance on an incomplete universe of systems with known LSL status.
- Representativeness of first- and fifth-liter sample results from a single State (Michigan).
- Variability of the ratio of first- and fifth-liter sample results from a single State.

Each of these limitations are described in more detail below.

1. Use of Historical SDWIS/Fed Data

As described previously in this section, the EPA recognizes the uncertainty in using historical SDWIS/Fed data to predict future 90th percentile values by developing "low" and "high" end estimates of the percent of CWSs in each P90 category.

2 Uncertainty in Predicting the Effects of Sampling from 100 Percent Sites Served by LSLs

For the 2021 LCRR and final LCRI, there is additional uncertainty in the effect of LSL systems being required to take all samples from LSL sites instead of the 50 percent minimum as required under the pre-2021 LCR. The EPA addressed this uncertainty by having a low and high estimate based on data

provided in Slabaugh al. (2015) paper, as was done for the Final 2021 LCRR EA[59]. However, as discussed in Section 3.3.5.1.1, the EPA also noted that the Slabaugh et al. (2015) was based on 72 monitoring periods from only 17 systems and the EPA did not have access to the data needed to conduct the analysis at a system level.

3 Reliance of Incomplete Universe of Systems with Known LSL Status

An important factor in the analyses to determine a system's initial lead 90th percentile categorization is the distinction between systems with LSLs and systems without LSLs. Limited data are available that indicate a system's LSL status; thus, the EPA conducted a series of analyses to evaluate the representativeness of the subset of 6,551 CWSs with known LSL status and at least one reported lead 90th percentile level during 2012-2020 as follows:

- Compared the subset of 6,551 CWSs with known LSL status and at least one reported lead 90th percentile level during 2012-2020 to all 49,529 CWSs in the SDWIS/Fed inventory.
- Compared the subset of 6,551 CWSs with known LSL status and at least one reported lead 90th percentile level during 2012-2020 to all 31,788 CWSs with at least one reported lead 90th percentile level during 2012 – 2020 and unknown LSL status.
- Determined the geographic representation of the 6,551 CWSs.

Each of these analyses are described in more detail below.

Comparison of Known LSL Status Subset to All CWSs

To help characterize the uncertainty of the subset of 6,551 with known LSL status and lead 90th percentile data used to determine a system's initial lead 90th percentile classification, the EPA compared this subset to the 49,529 active CWSs in SDWIS/Fed. As shown in Exhibit 3-27, although most of the 6,551 CWSs were those serving 3,300 or fewer people, they only represented 9 percent of all small CWSs. The subset of the 6,551 CWSs serving 3,301 to 50,000 people and serving more than 50,000 people comprised 26 percent and 52 percent of all CWSs that serve these size categories, respectively. The dataset of known LSL status systems is therefore less robust in its representation of water systems serving fewer than 3,300 people. The dataset is consistent in the degree of representation across the larger size categories representing water systems serving between 3,301 and 50,000 people and those serving greater than 50,000 people.

[59] The multiplier for the low estimate has changed since the 2021 LCRR economic analyses, due to more recent SDWIS/Fed data, as well as an updated list of systems with LSLs.

Exhibit 3-27: Comparison Percent of CWSs with Known LSL Status to All CWSs by System Size

System Size Population Served	Number of Active CWSs	CWSs with Known LSL Status and Lead 90th Percentile Data	
		Number of Systems	Percent of All CWSs by Size
	A	B	C = B/A
≤ 3,300	40,113	3,798	9%
3,301 to 50,000	8,400	2,220	26%
> 50,000	1,016	533	52%
Total	**49,529**	**6,551**	

Source: SDWIS/Fed, 4th quarter 2020 frozen dataset. Also see file, "Extent of P90 Data_LCR_Final.xlsx" for additional information.

Notes:

General: Refer to Section 3.3.5.1.1 and Exhibit 3-24 for more details on the development of the universe of systems with known LSL status.

A: Includes all active CWSs in SDWIS/Fed based on 4th quarter 2020 frozen dataset.

B: Includes systems with known LSL status (either presence or absence of LSLs) and at least one reported lead 90th percentile value to SDWIS/Fed during the 9-year analysis period of 2012 - 2020. Lead 90th percentile values for this subset of systems were used to determine a system's initial lead 90th percentile classification. See file "DWINSA_StateData_LSL_Status_Final.xlsx" for more information on how LSL status was determined.

Comparison of Known LSL Status Subset of All CWSs with Reported Lead 90th Percentile Data

The EPA compared the subset of systems with known LSL status and reported lead 90th percentile values to the larger set of CWSs with at least one reported lead 90th percentile value (but unknown LSL status) in SDWIS/Fed for 2012 - 2020. The first step was to generate the percentage of CWSs placed into each of the five lead 90th percentile categories (based on the maximum or "high estimate" lead 90th percentile value for 2012 – 2020) by four system size categories and CCT status using the larger dataset of 31,788 CWSs (*i.e.*, 38,339 minus 6,551 CWSs) that includes CWSs with at least one reported lead 90th percentile level during 2012 – 2020 and LSL status is unknown and the 6,551 CWSs with known LSL status. These values represent the data reported to SDWIS/Fed before any adjustments were made to simulate the requirements of the final LCRI. The results of this lead 90th percentile assessment are shown in Exhibit 3-28. Next, the EPA used a z-test to statistically evaluate the proportions for systems in each lead 90th percentile category for the two sets of systems. There were 16 categories of system size, CCT status, and lead 90th percentile category. However, since there were only two lead 90th percentile categories used (above and below the final AL of 10 µg/L), there were only eight independent z-tests. Of the eight z-tests, two returned a z-value falling within the critical range, indicating that differences in proportions observed between the two sets were not statistically significant. See file "P90_Unknown LSL vs LSL Known Status CWSs_Final.xlsx" for additional information.

Exhibit 3-28: Comparison of P90 Data for CWSs with At Least One Reported Value to the Set of CWSs with Known LSL Status and P90 Data by Two P90 Ranges, System Size, and CCT Status (Percent) Using the Baseline/High Estimate

System Size	CCT	Percent					
		P90 ≤ 10 µg/L			P90 >10 µg/L		
		w/ Reported P90	Reported P90 & Known LSL Status	Difference	w/ Reported P90	Reported P90 & Known LSL Status	Difference
		A	B	C = A-B	D	E	F = D-E
≤ 3,300	No	88.7%	89.5%	-0.9%	11.3%	10.5%	0.9%
≤ 3,300	Yes	85.4%	87.8%	-2.3%	14.6%	12.2%	2.3%
3,301-10K	No	93.2%	91.5%	1.6%	6.8%	8.5%	-1.6%
3,301-10K	Yes	93.4%	88.9%	4.5%	6.6%	11.1%	-4.5%
10,001-50K	No	96.2%	92.1%	4.1%	3.8%	7.9%	-4.1%
10,001-50K	Yes	94.4%	88.4%	6.0%	5.6%	11.6%	-6.0%
> 50K	No	No Data	100.0%	N/A	No Data	0.0%	N/A
> 50K	Yes	95.2%	87.9%	7.4%	4.8%	12.1%	-7.4%

Acronyms: LSL = lead service line; P90 = lead 90th percentile.

Source: SDWIS/Fed 4th Quarter Frozen Dataset, current through December 31, 2020. Also see file, "P90_Unknown LSL vs LSL Known Status CWSs_Final.xlsx" for additional detail.

Notes:

The summaries in this table represent data reported to SDWIS/Fed before any adjustments were made to simulate the requirements of the final LCRI.

A, D: Includes all 31,788 CWSs that equals all 38,339 CWSs with at least one reported P90 value minus the 6,551 CWSs with both a reported P90 value and known LSL status (*i.e.,* presence or absence of LSLs).

B, E: Includes the subset of 6,551 CWSs with both a reported P90 value and known LSL status.

Geographic Representativeness of Known LSL Status Subset

The EPA recognizes that using the subset of systems with known LSL status for the analysis may under or over represent 90th percentile results from specific geographic regions. To evaluate the potential impacts of this uncertainty, the EPA grouped known LSL status systems into five geographic regions:

1. East (Connecticut, Delaware, Maine, Massachusetts, Maryland, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, D.C., West Virginia),
2. Midwest (Iowa, Illinois, Indiana, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, Ohio, Oklahoma, and Wisconsin),
3. West (Arizona, California, Colorado, Idaho, Montana, New Mexico, North Dakota, Nevada, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming),
4. South (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Tennessee),
5. Other (Alaska, American Samoa, Hawaii, Northern Mariana Islands, and the EPA Region 9 Tribal Systems).

The 90th percentile values for these groups and for the full set of known LSL status systems (6,551) are shown in Exhibit 3-29. Note that in the 7th DWINSA Allocation Memorandum (USEPA, 2023a), a high percent of the allocation for lead service line replacement occurs for several midwest and northeast States, including Illinois, Indiana, Michigan, New York, Ohio, and Pennsylvania; however, the EPA recognizes uncertainty in not representing other geographic regions.

Exhibit 3-29: Number and Percent of CWSs with No ALE, and ALE – Comparison of Results from Five Geographic Regions with Known LSL Status Using the Baseline/High Estimate

Category	No LSLs				Has LSLs			
	Number of CWSs		Percent		Number of CWSs		Percent	
	No CCT	Yes CCT	No CCT	Yes CCT	No CCT	Yes CCT	No CCT	Yes CCT
East (Connecticut, Delaware, Maine, Massachusetts, Maryland, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, D.C., West Virginia)								
No ALE (P90 ≤10 µg/L)	629	776	91%	92%	73	386	94%	83%
ALE (P90 > 10 µg/L)	60	69	9%	8%	5	80	6%	17%
Midwest (Iowa, Illinois, Indiana, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, Ohio, Oklahoma, and Wisconsin)								
No ALE (P90 ≤10 µg/L)	1,017	706	89%	91%	288	513	84%	78%
ALE (P90 > 10 µg/L)	121	70	11%	9%	54	145	16%	22%
West (Arizona, California, Colorado, Idaho, Montana, New Mexico, North Dakota, Nevada, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming)								
No ALE (P90 ≤10 µg/L)	498	258	92%	95%	37	56	86%	97%
ALE (P90 > 10 µg/L)	43	14	8%	5%	6	2	14%	3%
South (Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Tennessee)								
No ALE (P90 ≤10 µg/L)	74	127	93%	95%	17	90	100%	95%
ALE (P90 > 10 µg/L)	6	6	8%	5%	0	5	0%	5%
Other (Alaska, American Samoa, Hawaii, Northern Mariana Islands, and the EPA Region 9 Tribal Systems)								
No ALE (P90 ≤10 µg/L)	260	32	92%	89%	1	100	100%	100%
ALE (P90 > 10 µg/L)	23	4	8%	11%	0	0	0%	0%
All Systems with Known LSL Status								
No ALE (P90 ≤10 µg/L)	2,478	1,899	91%	92%	416	1,145	86%	83%
ALE (P90 > 10 µg/L)	253	163	9%	8%	65	232	14%	17%

Acronyms: ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; P90 = lead 90th percentile level

Source: DWINSA_StateData_LSL_Status_Final.xlsx.

Notes: Includes only systems with known LSLs status **and** at least one reported lead 90th percentile (P90) to SDWIS/Fed for 2012 - 2020. CWSs were assigned to a P90 category of "No ALE" or "ALE" based on their highest reported lead P90 value reported to SDWIS/Fed for 2012-2020.

Representativeness of First- and Fifth-Liter Data from a Single State

The EPA used data from the State of Michigan to estimate the impact on the lead 90th percentile levels to simulate the expected increase in P90 values if they were based on the higher of the first- and fifth-liter sample under the final LCRI for LSL systems. As described earlier, an average ratio of the maximum of the first- and fifth-liter 90th percentile values to the first liter 90th percentile values from 181 systems in Michigan was applied to 90th percentile values from the subset of 6,551 systems with known LSL status that have a status of “Has LSLs” (1,758 systems) to determine the P90 category for systems under the final LCRI. The EPA recognizes the uncertainty introduced in using data from a single State that may not represent the values on a national level. However, the Michigan data represent actual compliance monitoring data collected recently from all systems within the State.

3.3.5.2 Likelihood of a System Having Multiple Lead ALEs

The EPA’s final LCRI requires water systems that have two lead ALEs in five years to prepare and submit a temporary filter plan to the State within 60 days of their second lead ALE. In addition, systems with at least three lead ALEs in a five-year period (*i.e.*, multiple lead ALEs) must provide enhanced community outreach and make pitcher filters available to the people that they serve (see Chapter 4, Section 4.3.6.4 for additional detail). The remainder of this section first provides the EPA’s approach for determining the percentage of systems with at least two lead ALEs, followed by those that subsequently have three or more lead ALE in five years.

3.3.5.2.1 Likelihood of a System Having Two Lead ALEs in Five Years

The EPA determined the percentages of CWSs, with at least one lead ALE, that within a period of five years had a second lead ALE, based on data reported to SDWIS/Fed during 2012 – 2020 in the fourth quarter 2020 frozen dataset. The analysis is restricted to the 6,551 CWSs with known LSL status and lead P90 data from SDWIS/Fed. Both a high and low estimate were calculated, using a similar method as discussed in Section 3.3.5.1.1 to adjust 90th percentile values to simulate the final rule changes to the lead tap sampling requirements. Note that this adjustment to the values from the 1,758 systems with LSLs is the only difference between the high and low estimates. The EPA determined that a CWS could only have two P90 results in any given year due to monitoring requirements. If a CWS reported more than two P90 values in a given year, the two highest reported values were used. These percentages are provided in Exhibit 3-30. Note that an ALE in this analysis refers to a system’s 90th percentile value being above 10 µg/L for lead, which is consistent with the final rule. Systems with LSLs were more likely than systems without LSLs to have two lead ALEs in a five-year period for every size category and CCT status. Note that the high estimate may result in a lower percentage than the low estimate. This is not unexpected, as using the high estimate will produce more systems that report an ALE, expanding the total pool of systems from which the percentages are calculated. The EPA assumed that NTNCWSs would have the same percentage of systems having at least two lead ALEs in a five-year period as CWSs.

Exhibit 3-30: Percentage of CWSs and NTNCWSs with At Least One ALE that Have At Least Two Lead Action Level Exceedances (Above 10 µg/L) in Five Years

System Size (Population Served)	Has LSLs		No LSLs	
	Has CCT	No CCT	Has CCT	No CCT
Low Estimate				
≤3,300	41.5%	27.1%	19.4%	10.5%
3,301–10,000	45.0%	56.8%	33.3%	15.8%
10,001–50,000	54.2%	29.5%	42.9%	16.7%
>50,000	66.1%	No Data	60.0%	No Data
High Estimate				
≤3,300	39.1%	22.9%	19.4%	10.5%
3,301–10,000	44.0%	59.2%	33.3%	15.8%
10,001–50,000	56.7%	30.0%	42.9%	16.7%
>50,000	66.9%	No Data	60.0%	No Data

Acronyms: CCT = corrosion control treatment; CWSs = community water system; LSLs = Lead Service Lines; NTNCWS = non-transient non-community water system.
Source: "Two Lead ALE_LCRI_10_AL_Final.xlsx."
Notes: The EPA assumed that the same percentage of NTNCWSs would have at least two lead ALEs in a five-year period as CWSs and that these percentages are representative of water systems with the same characteristics (*i.e.*, size, CCT, and LSL status).

3.3.5.2.2 Likelihood of a System with Two Lead ALEs Having Three or More Lead ALE in Five Years

The EPA also determined the percentages, by size and LSL and CCT status, of CWSs with at least two lead ALEs in a five-year period that have at least one additional lead ALE in five years, based on data reported to SDWIS/Fed during 2012 – 2020 in the fourth quarter 2020 frozen dataset.[60] The percentages were derived by calculating the proportion of systems that had at least three lead ALEs within a five-year timeframe, relative to the number of systems that had two ALEs in a period of five years (represented in Exhibit 3-30) between 2012 and 2020. The results of the analysis are detailed in Exhibit 3-31 below. Note that the exhibit shows a higher percentage of systems without LSLs having a third ALE in a five-year period than systems with LSLs in most categories. This is due to the small number of systems in the sample pool; note that when the percentages in Exhibit 3-31 are multiplied by the percentages of systems with two ALEs in Exhibit 3-30, and multiplied again by the percent of all systems with at least one ALE in Exhibit 3-26, the overall percent of systems with three lead ALEs in five years is higher for systems with LSLs compared to systems without LSLs for all categories except systems serving 10,001 to 50,000 with no CCT. There were no systems that have more than three lead ALEs in five years in this

[60] For the final LCRI EA, the EPA modified its approach for estimating multiple lead ALEs. For the proposed LCRI EA, the EPA determined the percentage of CWSs with at least three lead ALEs in a five-year period. For the final LCRI EA, the EPA determined the percentage of CWSs that have at least two lead ALEs in a five-year period that have at least one additional lead ALE. The EPA needed to change its approach to model the final rule requirement that systems with two lead ALEs would prepare a filter plan, but would not be required to conduct public education activities and filter distribution until the third lead ALE in the same five-year period.

category. The EPA assumed that NTNCWSs would have the same percentage of multiple lead ALEs as CWSs.

Exhibit 3-31: Percentage of CWSs and NTNCWSs with At Least Two Lead ALEs in Five Years that Have At Least One Additional Lead ALE (Above 10 µg/L) in Five Years

System Size (Population Served)	Has LSLs		No LSLs	
	Has CCT	No CCT	Has CCT	No CCT
Low Estimate				
≤3,300	37.0%	25.0%	50.0%	29.2%
3,301–10,000	42.2%	32.0%	55.6%	33.3%
10,001–50,000	35.0%	38.5%	0.0%	100.0%
>50,000	50.0%	No Data	33.3%	No Data
High Estimate				
≤3,300	48.1%	25.0%	50.0%	29.2%
3,301–10,000	39.6%	31.0%	55.6%	33.3%
10,001–50,000	33.6%	40.0%	0.0%	100.0%
>50,000	49.4%	No Data	33.3%	No Data

Acronyms: CCT = corrosion control treatment; CWSs = community water system; LSLs = Lead Service Lines; NTNCWS = non-transient non-community water system.
Source: "Multiple Lead ALE_LCRI_10_AL_Final.xlsx."
Notes: The EPA assumed that the same percentage of NTNCWSs would have multiple lead ALEs as CWSs and that these percentages are representative of water systems with the same characteristics (*i.e.*, size, CCT, and LSL status).

3.3.5.3 Likelihood of an Individual Lead Sample Exceeding the Lead AL

3.3.5.3.1 Baseline (2021 LCRR)

Under the 2021 LCRR, the EPA requires all systems to take specific actions in response to any single lead tap sample that is above 15 µg/L. Individual sample results are not available in SDWIS/Fed. Therefore, the EPA used available compliance monitoring data from the State of Michigan, which is the only State to date to require a first- and fifth-liter sample for LSL systems, to calculate the likelihood of an individual sample being greater than 15 µg/L based on system size, LSL status, and the five lead 90th percentile categories presented in Section 3.3.5.1. The analysis for the 2021 LCRR uses fifth-liter samples for systems with LSLs and first-liter samples for systems without LSLs from the Michigan dataset using the following steps:

Step 1 – Categorized Michigan systems as with or without LSLs based on compliance monitoring data as follows:

- The EPA assumed 193[61] CWSs have LSLs because the system provided first- and fifth-liter lead samples as required by Michigan's State-level regulation and were identified as having LSLs in their online service line inventory information (Michigan EGLE, 2020).
- The EPA assumed 975 CWSs have no LSLs because the system submitted only first-liter data and did not report any LSLs in the online service line inventory information.

Step 2 – Calculated lead 90th percentile levels: The EPA calculated lead 90th percentile (P90) values for CWSs as described below. The purpose of this step is to categorize each dataset by five P90 categories so that the likelihood of a sample being above 15 µg/L can be calculated for each 90th percentile category separately.

- For all systems with LSLs, to approximate the lead 90th percentile value if all samples were collected from LSL sites and all samples are fifth-liter samples as is required under the 2021 LCRR, the EPA calculated a P90 value using the fifth-liter concentrations. If an insufficient number of fifth-liter samples were available to meet minimum sampling requirements, the EPA used the highest first-liter sample results to meet the minimum requirements. The EPA used this P90 value to categorize the dataset by the five lead 90th percentile categories.
- For all systems with no LSLs, the EPA calculated the 90th percentile using all first-liter concentration data for each dataset and used this information to categorize the dataset by P90 level.[62]

Step 3 – Calculated the likelihood of a sample > 15 µg/L: The EPA calculated the proportion of samples above 15 µg/L for each 90th percentile category. Results are shown in Exhibit 3-32. Note that if first-liter samples were used to calculate the 90th percentile value for systems with LSLs having insufficient fifth-liter sampling data, those first-liter samples were not considered when calculating the proportion of samples above 15 µg/L.

Individual samples from systems with LSLs had a higher likelihood of being above 15 µg/L than individual samples from systems without LSLs when the system's calculated 90th percentile was less than or equal to 10 µg/L. Individual samples from systems without LSLs had a higher likelihood of being above 15 µg/L than individual samples from systems with LSLs when the system's calculated 90th percentile was greater than 10 µg/L. Note that although the percentage of individual lead samples above 15 µg/L from systems in the lead 90th percentile categories above the lead AL of 10 µg/L is higher for systems without LSLs than with LSLs, the overall percentage of individual lead samples above 15 µg/L from systems with LSLs is higher than from systems without LSLs (2.7 percent from systems with LSLs as opposed to 0.8 percent from systems without LSLs).[63] For additional detail on the number and percent of samples in the Michigan dataset that were greater than 15 µg/L, see file

[61] This total of 193 CWSs is different than the 181 Michigan CWSs used to adjust the lead 90th percentile data for systems with LSLs. The EPA excluded 12 systems that only reported non-detects for their fifth-liter samples, and had a determination of "No LSLs" based solely on Michigan's online service line inventory information.
[62] Note that the EPA discusses other potential sources of lead in premise plumbing, apart from lead and GRR service lines, in the final LCRI *Federal Register* notice in sections *IV.A Regulatory Approach* and *IV.E Tap Sampling for the Lead and Copper.*
[63] Overall, systems with LSLs have 101 samples > 15 µg/L out of a total of 3,685 samples (2.7%) while systems without LSLs have 79 samples > 15 µg/L out of a total of 9,613 samples (0.8%).

"Likelihood_Sample_Above_AL_LCRR_Find_Fix_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Note that the Michigan dataset does not include first- and fifth-liter data for NTNCWSs. Therefore, the EPA assumed the same likelihood for NTNCWSs as those presented in Exhibit 3-32 for CWSs. The text in red is the data input name used in the SafeWater LCR model.

Exhibit 3-32: Percent of Individual Lead Sample Results Above 15 µg/L Based on Michigan CWSs with Known LSL Status for the 2021 LCRR

LSL Status	P90 >15 µg/L	12 µg/L < P90 ≤ 15 µg/L	10 µg/L < P90 ≤ 12 µg/L	5 µg/L < P90 ≤ 10 µg/L	P90 ≤ 5 µg/L
	pp90above al15_1	*pp90above al15_2*	*pp90above al15_3*	*pp90above al15_4*	*pp90above al15_5*
Has LSLs	16.9%	9.3%	5.3%	3.1%	0.7%
No LSLs	22.2%	10.0%	7.9%	3.0%	0.4%

Acronyms: P90 = lead 90th percentile level.
Notes:
1. Although the percentage of individual lead samples above 15 µg/L from systems in the lead 90th percentile categories above 10 µg/L is higher for systems without LSLs than with LSLs, the overall percentage of individual lead samples from systems with LSLs is higher than from systems without LSLs (2.7 percent from systems with LSLs as opposed to 0.8 percent from systems without LSLs).
2. For additional detail, see file "Likelihood_Sample_Above_AL_LCRR_Find_Fix_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

3.3.5.3.2 Final LCRI

Under the final LCRI, the EPA's is maintaining the requirement for systems to take specific actions in response to any single lead tap sample that is above the lead action level, which is final at 10 µg/L. As was true for the 2021 LCRR, the EPA used available compliance monitoring data from the State of Michigan to calculate the likelihood of an individual sample being greater than 10 µg/L based on system size, LSL status, and the five lead 90th percentile categories presented in Section 3.3.5.1. The analysis for the final LCRI uses the maximum of the first- and fifth-liter samples for systems with LSLs and first liter samples for systems without LSLs from the Michigan dataset using the following steps:

Step 1 – Categorized Michigan systems as with or without LSLs based on compliance monitoring data. The EPA used the same assumptions to categorize water systems as described under Step 1 for the 2021 LCRR analysis (see Section 3.3.5.3.1).

Step 2 – Calculated lead 90th percentile levels: The EPA calculated lead 90th percentile values for CWSs with and without LSLs so that the likelihood of a sample being above 10 µg/L can be calculated for each of the five 90th percentile categories separately.

- For all systems with LSLs, to approximate the lead 90th percentile value if all samples were collected from LSL sites and all samples are the maximum of the first- and fifth-liter samples (new requirements in the final LCRI), the EPA calculated a lead 90th percentile value using the maximum of the first- and fifth-liter concentrations. The EPA used this 90th percentile to categorize the dataset by the five P90 categories.

- For all systems with no LSLs, the EPA used the same approach as the 2021 LCRR analysis by calculating the 90th percentile using all first-liter concentration data for each dataset and used this information to categorize the dataset by P90 level.

Step 3 – Calculated the likelihood of a sample > 10 µg/L: The EPA calculated the proportion of samples above 10 µg/L for each 90th percentile category. Results are shown in Exhibit 3-33.

Individual samples from systems with LSLs had a higher likelihood of being above 10 µg/L than individual samples from systems without LSLs when the system's calculated 90th percentile was greater than 15 µg/L or less than or equal to 5 µg/L. Individual samples from systems without LSLs had a higher likelihood of being above 10 µg/L than individual samples from systems with LSLs when the system's calculated 90th percentile was greater than 10 µg/L but less than 15 µg/L. When the system's calculated 90th percentile was between 5 and 10 µg/L, individual samples from systems with LSLs had an approximately equal chance of being above 10 µg/L as those from systems without LSLs. Note that the percentage of individual lead samples above 10 µg/L from systems in the two lead 90th percentile categories above the lead AL of 10 µg/L but below 15 µg/L is higher for systems without LSLs than with LSLs. The reason is the number of individual samples collected from systems with LSLs and a 90th percentile level above 10 µg/L is much higher than the number of individual samples from systems without LSLs and a 90th percentile above 10 µg/L. For example, of the systems with LSLs that are classified in the lead 90th percentile category of 12 µg/L < P90 ≤ 15 µg/L, 83 of the 495 individual lead samples from those systems are above 10 µg/L (16.8%) compared to 30 of 130 samples (23.1%) for non-lead service line systems. Note that the overall percentage of individual lead samples above 15 µg/L from systems with LSLs is higher than from systems without LSLs (2.7 percent from systems with LSLs as opposed to 0.8 percent from systems without LSLs).[64] For additional detail on the number and percent of samples in the Michigan dataset that were greater than 10 µg/L, see file "Likelihood_Sample_Above_AL_LCRI_DSSA_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Also note that the Michigan dataset does not include first- and fifth-liter data for NTNCWSs. Therefore, the EPA assumed the same likelihood for NTNCWSs as those presented in Exhibit 3-33 for CWSs. The text in red is the data input name used in the SafeWater LCR model.

Exhibit 3-33: Percent of Individual Lead Sample Result Above 10 µg/L Based on Michigan CWSs with Known LSL Status for the Final LCRI

LSL Status	P90 >15 µg/L	12 µg/L < P90 ≤ 15 µg/L	10 µg/L < P90 ≤ 12 µg/L	5 µg/L < P90 ≤ 10 µg/L	P90 ≤ 5 µg/L
	pp90above al10_1	*pp90above al10_2*	*pp90above al10_3*	*pp90above al10_4*	*pp90above al10_5*
Has LSLs	25.2%	16.8%	13.8%	6.5%	1.8%
No LSLs	22.2%	23.1%	21.1%	6.5%	0.5%

Acronyms: P90 = lead 90th percentile level.
Notes:

[64] Overall, systems with LSLs have 284 samples > 10 µg/L out of a total of 4,575 samples (6.2%) while systems without LSLs have 130 samples > 10 µg/L out of a total of 9,613 samples (1.4%).

1. Although the percentage of individual lead samples above 15 µg/L from systems in the lead 90th percentile categories above the lead AL of 10 µg/L but below 15 µg/L is higher for systems without LSLs than with LSLs, the overall percentage of individual lead samples from systems with LSLs is higher than from systems without LSLs.
2. For additional detail, see file "Likelihood_Sample_Above_AL_LCRI_DSSA_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

3.3.5.3.3 Discussion of Data Limitations and Uncertainty

Recent data from the State of Michigan were used to estimates the likelihood of a single sample result above 10 µg/L for systems with LSLs as compared to systems without LSLs. While there is uncertainty in the national representativeness of the data (*i.e.*, does lead tap sample data from Michigan represent lead tap data from other States), there are advantages to the use of these data. The Michigan data contains more than 14,100 individual lead sample results from systems with and without LSLs, with both first- and fifth-liter sampling results. To date, no other State requires both a first- and fifth-liter sample from sites served by LSLs. However, even with the large sample size, the relatively smaller sample size within each data category can introduce uncertainty.

3.3.5.4 Systems with Copper Only ALEs

The pre-2021 LCR set an AL concentration of 1.3 mg/L for copper. If a system exceeds the AL in more than 10 percent of tap water samples collected during any monitoring period (*i.e.*, if the 90th percentile level is greater than the AL), the system has not violated the rule but must conduct additional actions such as CCT steps, WQP monitoring, and source water monitoring. Requirements for systems that exceed both the lead and copper AL are considered in the analysis of lead ALE systems; thus, this section presents the estimates of systems with only copper ALEs.

The EPA reviewed SDWIS/Fed 90th percentile copper data from 2012 through 2020 to identify systems that had exceeded the copper AL but not the lead AL under the baseline conditions (*i.e.*, prior to the implementation of the final LCRI).[65] Thus, the analysis uses the ALE of 15 µg/L from the pre-2021 LCR as opposed to the final LCRI lead AL of 10 µg/L.[66]

The average annual percentage of all CWSs exceeding the copper AL without a lead exceedance during this time period is shown in Exhibit 3-34 by size, CCT status, and source type and was extremely low, indicating a low number of systems exceeded the copper AL only compared to the total number of systems in each category. For CWSs with CCT, the percentages ranged from zero percent for CWSs

[65] The EPA expanded the analysis period from the Proposed LCRI EA (USEPA, 2023b) from 2017 – 2020 to 2012 – 2020 to be more consistent with other EA analyses that use a nine-year analysis period. For CWSs with CCT, the overall percentage with a copper only ALE increased by about 0.2% using the expanded data set and was essentially the same for those without CCT. For NTNCWSs with CCT, the overall percentage with a copper only ALE increased by about 0.4% for those using GW and 0.9% for SW systems, based on the expanded analysis period. On the other hand, the percentages dropped to 0.1 to 0.2% for NTNCWSs without CCT using GW and SW, respectively, based on the expanded analysis period.
[66] Note this approach will overestimate the percentage of systems exceeding the copper AL under the 2021 LCRR and LCRI because more systems are expected to initially exceed the lead AL due to changes in the sampling protocol and 90th percentile calculations for systems with LSLs. In addition, the lower AL of 10 µg/L will also contribute to an expected increase in the number of systems initially exceeding the lead AL under the final LCRI.

serving greater than 1,000,000 people to 2.4 percent for GW systems serving 501 – 1,000 people. The overall percentage of CWSs with CCT and a copper ALE was approximately one percent. For those without CCT, 16 systems serving more than 50,000 people were b3 systems and had no copper ALEs. No CWS size or source without CCT category had a copper ALE percentage above 1.0 percent and, overall, all CWSs without CCT had an estimated copper exceedance percentage of around 0.4 percent. For a detailed information and for the number of systems exceeding the copper AL only in each category, see "CWS Inventory Characteristics_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Similar information is shown in Exhibit 3-35 for NTNCWSs. The overall percentages of NTNCWSs with a copper ALE were 3.2 percent and less than one percent for NTNCWSs with and without CCT, respectively. For additional detail, see "NTNCWS Inventory Characteristics_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Note that for the cost estimates presented in Chapter 4 for the final LCRI and Appendix B for the pre-2021 LCR and the 2021 LCRR, the EPA made a simplifying assumption that no system with CCT would have a copper ALE, because approximately 1 percent of CWSs and 3.0 percent of NTNCWSs with CCT were estimated to have a copper ALE. See Chapter 4, Section 4.3.2.3.1 and Appendix B for additional detail.

Exhibit 3-34: Average Percent of CWSs that Had Any Copper Only ALE from 2012-2020

System Size (Population Served)	Average (2012 –2020)					
	with CCT			without CCT		
	Ground Water	Surface Water	All Sources	Ground Water	Surface Water	All Sources
≤100	1.9%	0.7%	1.6%	0.3%	1.0%	0.4%
101–500	1.7%	0.9%	1.4%	0.4%	0.7%	0.4%
501–1,000	2.4%	0.6%	1.7%	0.4%	0.6%	0.5%
1,001–3,300	2.1%	0.4%	1.4%	0.5%	0.3%	0.4%
3,301–10,000	1.2%	0.2%	0.6%	0.3%	0.2%	0.3%
10,001–50,000	1.0%	0.2%	0.4%	0.1%	0.1%	0.1%
50,001–100,000	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
100,001–1M	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
>1M	0.0%	0.5%	0.5%			
All Sizes	**1.7%**	**0.4%**	**1.1%**	**0.4%**	**0.5%**	**0.4%**

Source: "CWS Inventory Characteristics_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. The EPA estimated that 16 CWSs are b3 systems, serve 50,001 – 1 million people, and have no CCT. No b3 systems serve more than 1 million people. Refer to Section 3.3.3 for the EPA's approach for estimating the number of b3 systems based on SDWIS/Fed fourth quarter 2020 frozen dataset.
2. The gray shaded cells denote that there were no CWSs serving >1M people without CCT in the CWS inventory.

Exhibit 3-35: Average Percent of NTNCWSs that Had Any Copper Only ALE from 2012–2020

System Size	Average (2012–2020)					
	with CCT			without CCT		
	Ground Water	Surface Water	All Sources	Ground Water	Surface Water	All Sources
≤100	3.8%	4.4%	3.8%	0.6%	0.3%	0.6%
101–500	2.8%	1.7%	2.7%	0.6%	1.2%	0.7%
501–1,000	3.5%	1.0%	3.3%	0.6%	1.2%	0.6%
1,001–3,300	3.7%	1.2%	3.3%	0.8%	1.7%	0.9%
3,301–10,000	1.3%	0.0%	1.0%	0.1%	0.7%	0.3%
10,001–50,000	0.0%	0.0%	0.0%	1.5%	0.7%	1.0%
50,001–100,000		0.0%	0.0%			
100,001–1M		0.0%	0.0%			
>1M						
All Sizes	**3.3%**	**1.8%**	**3.2%**	**0.6%**	**0.9%**	**0.6%**

Source: "NTNCWS Inventory Characteristics_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. The gray shaded cells denote that for NTNCWSs with CCT, no GW NTNCWSs serve more than 50,000 people and no SW NTNCWSs serve more than > 1M people.
2. For NTNCWSs without CCT, none serve more than 50,000 people, regardless of their water source.

3.3.6 Treatment Plant Characterization

This section explains the baseline inputs for the following treatment-related PWS characteristics:

- Entry points per system
- Average daily flow
- Design flow
- pH of finished water
- Orthophosphate (PO_4) dose

For additional detail and values used in this EA, see the file, "Baseline CCT Characteristics.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

3.3.6.1 Entry Points per System

Entry points are the locations where source water is treated (in the case of the LCR where CCT occurs) and enters the distribution system. Systems can have multiple entry points. The EPA developed estimates of entry points per system using unique sampling point data from UCMR 3 (USEPA, 2017), along with SDWIS/Fed facility data, and a modeled frequency distribution.

The UCMR 3 data record a unique identifying number for the entry point sample location(s) for each system. Given the information provided, the EPA assumed that the number of unique sample point IDs per system approximates the total number of entry points per system.

For systems without UCMR 3 occurrence data, the EPA developed estimates based on SDWIS/Fed facility data. The SDWIS/Fed data include unique identification numbers for system facilities, as well as facility type and activity status. This analysis relies on active facilities identified as treatment plants. Using the assumption that treatment plants are associated with one entry point, the SDWIS/Fed facility data provide an approximation for the number of entry points per system when a system does not have UCMR 3 occurrence data. The EPA considers the UCMR 3 sampling point data to be of higher quality than the SDWIS/Fed treatment facility data. If the SDWIS/Fed treatment facility data value for a system exceeded the maximum number found for the equivalent system size and source water combination in the UCMR 3 data, the EPA limited the system entry point value to the UCMR 3 maximum number of entry points.

For systems without UCMR 3 occurrence data or SDWIS/Fed facility data, the EPA relies on an estimate of the number of entry points. The estimated value for each system with missing entry point count data was imputed from known entry point counts for stratified SDWIS/Fed data. Within each stratum, defined by a combination of system size and source water, the EPA sampled from systems with known entry point counts. Sampling was done with replacement after truncating the entry point counts to the maximum recorded in UCMR 3. For reproducibility, the EPA performed this sample-based imputation in R using the 'base::sample' function (R Core Team, 2021).

Following this process, the EPA relied on sample point values recorded in UCMR 3 for 5,419 systems, SDWIS/Fed facility data for 43,563 systems, and imputed entry point values for 17,523 systems. All

systems have at least one entry point. Among CWSs, the maximum number of entry points is 202, and the mean is 1.80. Among NTNCWSs, the maximum number of entry points is 22, and the mean is 1.31.

Exhibit 3-36 summarizes the final frequency distribution of entry point input ranges for each CWS stratum of size and source water combination. Exhibit 3-37 summarizes the final frequency distribution of entry point input ranges for each NTNCWS stratum of size and source water combination. These distributions are used to proportionally assign numbers of entry points to systems in each system size and type category.[67]

Exhibit 3-36: Frequency Distribution of Entry Point Inputs for CWSs

System Size (Population Served	Ground Water							Surface Water						
	1 EP	2–5 EP	6–10 EP	11–15 EP	16–20 EP	21–100 EP	> 100 EP	1 EP	2–5 EP	6–10 EP	11–15 EP	16–20 EP	21–100 EP	> 100 EP
≤ 100	90%	10%	0.1%	0	0	0	0	87%	13%	0	0	0	0	0
101–500	76%	24%	0	0	0	0	0	84%	16%	0	0	0	0	0
501–1,000	62%	38%	0.5%	0	0	0	0	76%	23%	0.8%	0	0	0	0
1,001–3,300	48%	50%	1%	0	0	0	0	70%	30%	0.7%	0	0	0	0
3,301–10,000	32%	59%	8%	0.9%	0.1%	0	0	54%	43%	3%	0.5%	0.04%	0	0
10,001–50,000	3%	58%	28%	7%	3%	1%	0.07%	3%	82%	10%	2%	1%	0.6%	0
50,001–100,000	0	51%	25%	8%	8%	9%	0	0.2%	74%	13%	6%	2%	4%	0
100,001–1M	0	34%	22%	11%	8%	24%	1%	0.3%	67%	13%	4%	9%	6%	0.3%

Acronyms: CWS – community water systems; EP – entry point.

Exhibit 3-37: Frequency Distribution of Entry Point Inputs for NTNCWSs

System Size (Population Served	Ground Water					Surface Water				
	1 EP	2–5 EP	6–10 EP	11–20 EP	> 20 EP	1 EP	2–5 EP	6–10 EP	11–20 EP	> 20 EP
≤ 100	84%	16%	0.4%	0	0	82%	18%	0	0	0
101–500	81%	19%	0	0	0	74%	26%	0	0	0
501–1,000	0	0	0	0	0	0	0	0	0	0
1,001–3,300	68%	30%	2%	0	0	61%	31%	8%	0	0
3,301–10,000	53%	44%	2%	1%	0	35%	44%	14%	6%	0
10,001–50,000	10%	80%	0	10%	0	30%	40%	5%	20%	5%
50,001–100,000	0	0	0	0	0	0	100%	0	0	0
100,001–1M	0	0	0	0	0	0	100%	0	0	0

Acronyms: NTNCWS” – non-transient non-community water systems; EP – entry point.

[67] The SDWIS/Fed data provide information on the PWS characteristics that typically define PWS categories, or strata, for which the EPA develops costs in rulemakings. These characteristics include system type (CWS, NTNCWS), number of people served by the PWS, PWS's primary raw water source (GW or SW), PWS's ownership type (public or private), and PWS state. For more information on the use of baseline and compliance characteristics to define model systems in the EPA's cost analysis, please see Section 3.2.

3.3.6.2 Average Daily Flow and Design Flow

Average daily production flow and design flow per system are based on regression equations from the EPA Report, *Geometries and Characteristics of Public Water Supplies* (USEPA, 2000). The average daily flow and design flow are functions of the population served, with different equations for source water type (surface or ground water), ownership (public or private) and for purchased and non-purchased systems. The flow was then divided by the number of entry points to calculate the flow per treatment plant for the system (assuming each entry point has one treatment plant). As a conservative estimate, the flow-population regression equations for CWSs were also used for NTNCWSs.

The EPA evaluated historical SDWIS/Fed data to determine the proportion of systems with CCT that use pH adjustment, orthophosphate (PO_4) treatment, or both. This analysis is detailed in Chapter 4, Section 4.3.2.2.1.

Baseline pH levels and PO_4 dosages are also important inputs in calculating the incremental costs of the final LCRI. The EPA used the SYR3 ICR dataset to characterize the distribution of finished water pH for those systems that have CCT installed and those that do not under baseline conditions. The EPA also estimated the distribution of PO_4 dosages for large, medium, and small systems with and without LSLs. See the file, "Baseline CCT Characterization.xlsx" for additional detail and for final baseline pH and PO_4 input values used to develop costs and benefits for this EA.

3.3.6.3 Discussion of Data Limitations and Uncertainties

The EPA recognizes that there is uncertainty in assuming a system's total flow is divided equally among each entry point because a single system may have a mix of large and small plants to support their population. There is also uncertainty in using the equations from the 2000 Geometries Document (USEPA, 2000) to predict future average daily and design flow based on a system's retail population. Water use efficiency has increased substantially since the 1980's, with a major improvement between 2005 and 2010 (Rockaway et al., 2011). A 2016 Water Research Foundation study reported a 22 percent decline in indoor water use between 1999 and 2016 (WaterRF, 2016). The trend of lower residential water use could result in lower flow per population and lower treatment costs as compared to predicted values in this EA.

3.3.7 Lead and Copper Tap Schedules

This section describes the EPA's approach for estimating water systems' initial lead and copper tap monitoring schedules under the 2021 LCRR and final LCRI. As a starting point, the EPA estimated the likelihood a system would be on a standard six-month monitoring or one of the reduced lead and copper tap monitoring schedules under the pre-2021 LCR. This approach is detailed in Section 3.3.7.1.

Section 3.3.7.2 describes how the EPA adapted the pre-2021 schedules to determine the initial lead and copper tap monitoring period under the 2021 LCRR and final LCRI. Note that these schedules do not apply to systems implementing a point-of-use (POU) program under the small system flexibility option. Those systems must sample one-third of POU sites annually to assess performance. Section 3.3.7.4 provides a discussion of the data limitations and uncertainty.

3.3.7.1 Estimating Initial Lead and Copper Tap Monitoring Period under the Pre-2021 LCR

Under the pre-2021 LCR, systems on routine (semi-annual) lead and copper tap sampling could qualify for reduced sampling by meeting specific criteria. These criteria varied for the three broad LCR system size categories.[68] Reduced monitoring allows a system to collect lead and copper tap samples from a reduced number of sites on an annual, triennial, or 9-year tap sampling monitoring period.

Exhibit 3-38 provides a summary of the criteria used to estimate the various lead and copper tap monitoring schedules under the pre-2021 LCR based on information reported to SDWIS/Fed in the fourth quarter frozen dataset, current through December 31, 2020.

Exhibit 3-38: SDWIS/Fed Criteria Used to Estimate Lead Tap Sampling Monitoring Schedules under the Pre-2021 LCR

Monitoring Frequency	Description
6-Month at standard number of sites	• System serves 50,000 or fewer people and its latest lead or copper action level exceedance (ALE) of 15 µg/L or 1.3 mg/L, respectively, occurred after 12/31/2019. Thus, the system did not have two consecutive 6-month monitoring periods without a lead and/or copper ALE. • System serves more than 50,000 people, has CCT, and a lead ALE, or a 59 violation that indicates non-compliance with State-specified optimal water quality parameters (OWQPs), any of which occurred after 12/31/2019.
Annual at reduced number of sites	• System serves 50,000 or fewer people and its latest lead or copper ALE occurred between 1/1/2018 and 12/31/2019. Thus, the system had two consecutive 6-month monitoring periods without a lead or copper ALE. • System serves more than 50,000 people, has CCT, and its latest lead ALE a 59 violation) occurred between 1/1/2018 and 12/31/2019.
Triennial at reduced number of sites	• System serves 50,000 or fewer people and meets one of the following criteria: a. Any lead or copper ALE occurred before 1/1/2018; or b. Does not meet the criteria for 9-year monitoring listed below. • System serves >50,000 people and meets one of the following criteria: a. Satisfies the b3 criteria[1]; or b. Has CCT, no lead ALE, and no 59 violation for the most recent 3 or more consecutive years; or c. Has CCT, no lead ALE, and a 59 violation for which the system has achieved compliance for at least the 3 most consecutive years.
Every 9 years at reduced number of sites	• System serves a population of ≤ 1,000[2] and meet all of the following conditions in a. through e.: a. Is a mobile home park (CWS only)[2], and b. Has no CCT[2], and c. Had no lead or copper exceedances during 1992 – 2020[3], and d. The sampling period is for both lead and copper sampling is ≥ 9 years[3] or no 90th percentile data were reported to SDWIS/Fed[4]. e. Has a first reported date in SDWIS/Fed on or after January 1, 1989.[5]

Source: For additional information see "Pb Schedules_CWS_Final.xlsx" and "Pb Schedules_NTNCWS_Final.xlsx," both available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

[68] The pre-2021 LCR defines three broad size categories: Systems serving more than 50,000 people, systems serving 3,301 to 50,000 people, and systems serving 3,300 or fewer people. Some of the requirements of the rule varied across these size categories.

Notes:
[1] For purposes of this analysis, the EPA identified a systems as a b3 system if it met all of the following criteria: 1) served more than 50,000 people; 2) had a reported"B3" milestone; 3) did not have CCT (refer back to Section 3.3.3); and 4) did not have a lead or copper ALE and all reported lead 90th percentile values are ≤ 5 µg/L or non-detect during 1992 -2020.
[2] SDWIS/Fed does not have a milestone or other required reporting that identifies systems on 9-year monitoring. Although the rule allows systems serving ≤ 3,300 people to qualify for 9-year monitoring, the EPA assumed only a subset of systems serving ≤ 1,000 people met this requirement. The EPA further assumed only water systems that became active after January 1, 1989 (based on the first reported date) would qualify for 9-year monitoring. The EPA selected this date because it is well after when systems stopped using LSLs and when all States had to adopt the lead provisions (*i.e.*, by August 6, 1988) that limited the amount of lead in plumbing materials.
[3] The length of the tap sampling period was determined by the difference between the sampling period begin and end dates. The EPA assumed if the difference was greater than one year, but the system did not meet the 9-year monitoring criteria, it was on triennial monitoring.
[4] The pre-2021 LCR only requires States to report 90th percentile levels to SDWIS/Fed that are above the lead AL for systems serving ≤ 3,300 people and above the copper AL for any size system.
[5] The first reported date may indicate when the system became operational. The 1986 SDWA Amendments banned the use of lead pipe and required the use of "lead-free" solders, fluxes, pipes and pipe fittings in the installation or repair of public water systems. States were required to implement this ban by August 6, 1988. The EPA assumed these systems that came on-line after 1988 and the system and customers they serve would be more likely to use lead-free plumbing materials that would allow the system to meet the requirements for a 9-year monitoring waiver.

Based on the criteria in Exhibit 3-38 the majority of CWSs are on triennial monitoring under the pre-2021 LCR. See Exhibit 3-39 and Exhibit 3-40, for additional detail on CWSs with CCT and without CCT, respectively. Note that the text in red font and italics are variable names of the costing inputs for the SafeWater LCR model.

Exhibit 3-39: Estimated Percentage of CWSs with CCT on Various Lead Tap Monitoring Schedules by Size and Source Type under the Pre-2021 LCR

System Size (Population Served)	CWS with CCT: Surface Water				CWS with CCT: Ground Water			
	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)
	A	B	C	D	E	F	G	H
	1-(B+C+D)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*	1-(F+G+H)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*
≤100	1.2%	2.2%	96.5%	0%	2.8%	5.5%	91.7%	0%
101–500	1.7%	2.5%	95.8%	0%	2.5%	3.7%	93.9%	0%
501–1,000	0.5%	1.5%	97.9%	0%	2.6%	3.8%	93.6%	0%
1,001–3,300	0.7%	2.3%	97.0%	0%	2.6%	3.4%	94.0%	0%
3,301–10,000	0.6%	1.4%	98.0%	0%	1.5%	2.6%	95.8%	0%
10,001–50,000	0.5%	1.5%	98.0%	0%	1.2%	1.6%	97.3%	0%
50,001–100,000	2.5%	2.5%	95.0%	0%	0.6%	1.3%	98.1%	0%
100,001–1M	2.9%	1.7%	95.3%	0%	1.4%	0.0%	98.6%	0%
>1M	0.0%	0.0%	100.0%	0%	0.0%	0.0%	100.0%	0%

Source: For additional information, see "Pb Schedules_CWS_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. Refer to Exhibit 3-38 for the criteria the EPA applied to determine systems' lead and copper tap monitoring schedules and Section 3.3.3 for the criteria the EPA used to identify systems with and without CCT.
2. Systems on annual, triennial, or 9-year monitoring collect samples at the reduced number of sites specified in the rule (see 40 CFR 141.86(c)). As will be discussed in Section 3.3.7.2, under the 2021 LCRR and final LCRI, systems monitoring annually must collect from the standard number of sites.

Exhibit 3-40: Estimated Percentage of CWSs without CCT on Various Lead Tap Monitoring Schedules by Size and Source Type under the Pre-2021 LCR

System Size (Population Served)	CWS without CCT: Surface Water				CWS without CCT: Ground Water			
	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)
	A	B	C	D	E	F	G	H
	1-(B+C+D)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*	1-(F+G+H)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*
≤100	1.7%	3.9%	92.5%	1.9%	1.1%	2.2%	95.4%	1.4%
101–500	1.3%	3.2%	94.3%	1.2%	1.0%	2.3%	95.9%	0.8%
501–1,000	0.9%	2.9%	95.8%	0.3%	1.0%	1.5%	97.2%	0.4%
1,001–3,300	0.6%	1.9%	97.4%	0.0%	0.8%	1.4%	97.9%	0.0%
3,301–10,000	1.2%	1.2%	97.6%	0.0%	0.2%	0.8%	99.0%	0.0%
10,001–50,000	0.4%	0.4%	99.1%	0.0%	0.6%	0.7%	98.7%	0.0%
50,001–100,000	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%
100,001–1M	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%
>1M								

Source: For additional information, see "Pb Schedules_CWS_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. Refer to Exhibit 3-38 for the criteria the EPA applied to determine systems' lead and copper tap monitoring schedules and Section 3.3.3 for the criteria the EPA used to identify systems with and without CCT.
2. Systems on annual, triennial, or 9-year monitoring collect samples at the reduced number of sites specified in the rule (see 40 CFR 141.86(c)). As will be discussed in Section 3.3.7.2, under the 2021 LCRR and final LCRI, systems monitoring annually must collect from the standard number of sites.
3. The gray shaded cells denote that there were no CWSs serving >1M people without CCT in the CWS inventory.

Exhibit 3-41 and Exhibit 3-42 provide similar information for NTNCWSs with CCT and without CCT, respectively under the pre-2021 LCR.

Exhibit 3-41: Estimated Percentage of NTNCWSs with CCT on Various Lead Monitoring Schedules by Size and Source Type under the Pre-2021 LCR

System Size (Population Served)	NTNCWS with CCT: Surface Water				NTNCWS with CCT: Ground Water			
	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)
	A	B	C	D	E	F	G	H
	1-(B+C+D)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*	1-(F+G+H)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*
≤100	0.0%	8.0%	92.0%	0.0%	4.7%	10.7%	84.7%	0.0%
101–500	4.3%	4.3%	91.3%	0.0%	4.5%	6.1%	89.4%	0.0%
501–1,000	4.5%	0.0%	95.5%	0.0%	4.7%	8.6%	86.7%	0.0%
1,001–3,300	0.0%	10.7%	89.3%	0.0%	4.4%	5.6%	90.0%	0.0%
3,301–10,000	0.0%	11.1%	88.9%	0.0%	4.0%	12.0%	84.0%	0.0%
10,001–50,000	0.0%	0.0%	100.0%	0.0%	0.0%	33.3%	66.7%	0.0%
50,001–100,000	100.0%	0.0%	0.0%	0.0%				
100,001–1M	0.0%	0.0%	100.0%	0.0%				
>1M								

Source: For additional information, see "Pb Schedules_NTNCWS_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. Refer to Exhibit 3-38 for the criteria the EPA applied to determine systems' lead and copper tap monitoring schedules and Section 3.3.3 for the criteria the EPA used to identify systems with and without CCT.
2. Systems on annual, triennial, or 9-year monitoring collect samples at the reduced number of sites specified in the rule (see 40 CFR 141.86(c)). As will be discussed in Section 3.3.7.2, under the 2021 LCRR and final LCRI, systems monitoring annually must collect from the standard number of sites.
3. The gray shaded cells denote that for NTNCWSs with CCT, no SW NTNCWSs serve more than 1 M people and no GW NTNCWSs serve more than 50,000 people i.

Exhibit 3-42: Estimated Percentage of NTNCWSs without CCT on Various Lead Tap Monitoring Schedules by Size and Source Type under the Pre-2021 LCR

System Size (Population Served)	NTNCWS without CCT: Surface Water				NTNCWS without CCT: Ground Water			
	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)
	A	B	C	D	E	F	G	H
	1-(B+C+D)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*	1-(F+G+H)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*
≤100	1.3%	2.2%	64.0%	32.4%	2.1%	3.7%	73.9%	20.3%
101–500	2.5%	5.0%	78.1%	14.4%	2.1%	3.7%	82.7%	11.6%
501–1,000	1.5%	7.5%	73.1%	17.9%	2.0%	2.5%	85.3%	10.2%
1,001–3,300	4.4%	5.5%	90.1%	0.0%	2.5%	3.9%	93.6%	0.0%
3,301–10,000	2.0%	0.0%	98.0%	0.0%	1.3%	1.3%	97.4%	0.0%
10,001–50,000	0.0%	0.0%	100.0%	0.0%	0.0%	6.7%	93.3%	0.0%

System Size (Population Served)	NTNCWS without CCT: Surface Water				NTNCWS without CCT: Ground Water			
	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)	6 Month (Standard)	Annual (Reduced)	Triennial (Reduced)	9 Year (Reduced)
	A	B	C	D	E	F	G	H
	1-(B+C+D)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*	1-(F+G+H)	*p_tap_annual*	*p_tap_triennial*	*p_tap_nine*
50,001–100,000								
100,001–1M								
>1M								

Source: For additional information, see "Pb Schedules_NTNCWS_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1 Refer to Exhibit 3-38 for the criteria the EPA applied to determine systems' lead and copper tap monitoring schedules and Section 3.3.3 for the criteria the EPA used to identify systems with and without CCT.

2 Systems on annual, triennial, or 9-year monitoring collect samples at the reduced number of sites specified in the rule (see 40 CFR 141.86(c)). As will be discussed in Section 3.3.7.2, under the 2021 LCRR and final LCRI, systems monitoring annually must collect from the standard number of sites.

3 The gray shaded cells denote no NTNCWSs without CCT serve more than 50,000 people, regardless of their water source.

3.3.7.2 Estimating Lead and Copper Tap Monitoring Schedules under the 2021 LCRR

To determine the initial monitoring requirements under the 2021 LCRR, the EPA assumed all systems with lead content or unknowns would monitor semi-annually for the first year of the analysis period (Year 4) with the exception of systems in Michigan because they would have already monitored according to the new sampling protocol required under the 2021 LCRR prior to the rule's compliance date. As a simplifying approach, the EPA modeled all water systems in Michigan as having all non-lead service lines.[69]

For systems with all non-lead service lines that do not exceed the lead AL of 15 µg/L under the 2021 LCRR, the EPA assumed systems will retain their monitoring schedule from the pre-2021 LCR. Thus, they would have the same likelihood of being on one of the four monitoring schedules presented in Exhibit 3-39 through Exhibit 3-42, except that those qualifying for annual monitoring must collect the standard number of samples under the 2021 LCRR.

Systems with all non-lead service lines that have:

- A lead ALE under the 2021 LCRR must monitor semi-annually at the standard number of sites until they qualify for reduced monitoring.
- A lead TLE under the 2021 LCRR but no lead or copper ALE must monitor annually at the standard number of sites.

[69] There is uncertainty in using this approach because Michigan did not require first- and fifth-liter samples for systems with GRR service lines but no LSLs. For these systems, the burden and cost for lead tap monitoring may be underestimated.

As a simplifying assumption, the EPA assumed all systems will begin their monitoring cycle in Year 4 of the analysis period resulting in an overestimation of sampling costs associated with the 2021 LCRR.

3.3.7.3 Estimating Lead and Copper Tap Monitoring Schedules under the LCRI

To determine the initial monitoring requirements under the LCRI, the EPA assumed all systems with lead content would monitor semi-annually for the first year (Year 4) with the exception of systems in Michigan because they would have monitored according to the new sampling protocol required under the LCRI prior to the rule's compliance date.

Systems with no lead content service lines or unknowns that do not exceed the lead AL of 10 µg/L under the LCRI will retain their monitoring schedule from the pre-2021 LCR. Thus, they would have the same likelihood of being on one of the four monitoring schedules presented in Exhibit 3-39 through Exhibit 3-42, except that those qualifying for annual monitoring must collect the standard number of samples under the LCRI. Systems with no lead content service lines that have a lead ALE or OWQP violation must monitor semi-annually at the standard number of sites until they qualify for reduced monitoring.[70] As a simplifying assumption, the EPA assumed all systems will begin their monitoring cycles in Year 4 of the analysis period resulting in an overestimation of sampling costs associated with the LCRI.

Exhibit 3-43 provides a comparison of the criteria for increased and reduced tap sample monitoring under the pre-2021 LCR, 2021 LCRR, and final LCRI.

[70] As a simplifying assumption, the tap monitoring schedules do not take into account copper ALEs, which are handled separately as described in Section 3.3.5.4.

Exhibit 3-43: Comparison of the Criteria for Standard and Reduced Tap Sample Monitoring under the Pre-2021 LCR, 2021 LCRR, and Final LCRI

Frequency and # of Samples	Pre-2021 LCR Criteria for Lead and Copper	2021 LCRR Criteria for Lead	2021 LCRR Criteria for Copper	Final LCRI Criteria for Lead	Final LCRI Criteria for Copper
Semi-Annually at Routine Number of Sites	• Lead and/or copper ALE[1] during any tap sampling monitoring period; and/or • Has an OWQP excursion[2] for more than 9 days in a 6-month period.	• Has a lead ALE[1] during any tap monitoring period; • After State sets OWQPs following CCT installation or re-optimization; • Lead ALE or has an OWQP excursion[2] for more than 9 days in a 6-month period; • New water systems that begin operation after effective date; or • Initial monitoring: Systems with LSLs including b3 systems[3] unless have prior monitoring data.[4]	• Cu90 is > 1.3 mg/L during any tap monitoring period; and/or • Has an OWQP excursion[2] for more than 9 days in a 6-month period; or • New water systems that begin operation after effective date.	• Has a lead and/or copper ALE[5] during any tap monitoring period; and/or • Has an OWQP excursion[2] for more than 9 days in a 6-month period, or • New water systems that begin operation after effective date. • Initial monitoring: Systems with lead and GRR service lines, including b3 systems[3], unless have prior monitoring data.[4]	• Same criteria as lead.
Annually at Standard Number of Sites	N/A	• No lead or copper ALE, & meets OWQP specifications (if applicable) for 2 consecutive 6-month tap monitoring periods.	• Has a lead TLE[6], no lead or copper ALE, & meets OWQP specifications (if applicable) for 2 consecutive 6-month tap monitoring periods.	• No lead and/or copper ALE[5] & meets OWQP specifications (if applicable) for 2 consecutive 6 months.	• N/A. Systems that qualify for annual monitoring collect copper samples at the reduced number of sites.

Frequency and # of Samples	Pre-2021 LCR Criteria for Lead and Copper	2021 LCRR Criteria for Lead	2021 LCRR Criteria for Copper	Final LCRI Criteria for Lead	Final LCRI Criteria for Copper
Annually at Reduced Number of Sites	• Serves ≤ 50,000 people: No lead or copper ALE for 2 consecutive 6-month tap monitoring periods. • All sizes: No lead ALE & meets OWQP. specifications (if applicable) for 2 consecutive 6-month tap monitoring periods.	N//A. Systems cannot monitor annually at the reduced number of sites for lead.	• No lead TLE[6], no copper ALE, & meets OWQP specifications (if applicable) for 2 consecutive 6-month tap monitoring periods.	N/A	• No lead or copper ALE & meets OWQP specifications (if applicable) for 2 consecutive 6-month tap monitoring periods.
Triennially at Reduced Number of Sites	• Serves ≤ 50,000 people: No lead or copper ALE for 3 consecutive years. • All sizes: ○ No lead ALE and met OWQP specifications for 3 consecutive years; or ○ Meet 40 CFR 141.81(b)(3);[2] or ○ Meets accelerated reduced criteria for /lead and copper.[6]	• Serves ≤ 50,000 people: No lead TLE[5] or ALE, no copper ALE, & meets OWQP specifications (if applicable) for ≥ 3 consecutive years. • All sizes: Meets accelerated reduced criteria for lead.[6]	• Serves ≤ 50,000 people: Cu90 is ≤ 1.3 mg/L and meets OWQP specifications for 3 consecutive years. • All sizes: ○ Meets 40 CFR 141.81(b)(3) criteria[3] and OWQP specifications (if applicable); or ○ Meets accelerated criteria for copper.[6]	• No lead or copper ALE[5] & meets OWQP specifications (if applicable) for 3 consecutive years (with State approval); or • Meets 40 CFR 141.81(b)(3) criteria[3] and OWQP specifications (if applicable); or • Meets accelerated reduced criteria for lead and copper.[7]	• Same criteria as lead.
Every Nine Years at Reduced Number of Sites	Serves ≤ 3,300 people: Lead and copper 90th percentile levels are ≤ 5 µg/L and ≤ 0.65 mg/L, respectively, and all plumbing materials are free of lead- and copper-containing materials including those in buildings and residences served by the system.				

[1] Under the pre-2021 LCR and 2021 LCRR, a system has a lead ALE if its 90th percentile lead level and 90th percentile copper level were above 15 µg/L and 1.3 mg/L, respectively.
[2] OWQPs are measured to determine whether a system is operating its CCT at a level that most effectively minimizes the lead and copper concentrations at users' taps. An excursion occurs when the daily value of a WQP is below the minimum value or outside the OWQP range set by the State. This definition is the same for the pre-2021 LCR, 2021 LCRR, and LCRI.
[3] Under the pre-2021 LCR, a system met the criteria in 40 CFR 141.81(b)(3) if for two consecutive 6-month monitoring periods, the system's lead 90th percentile level minus its highest source water level was < 5 µg/L or its source water lead was less than the lead method detection limit and its P90 was ≤ 5 µg/L. The 2021 LCRR modified these criteria to specify they are met if for two consecutive six-month tap sampling monitoring periods, the system's lead 90th percentile level is ≤ the practical quantitation limit of 0.005 mg/L. The LCRI further expands the "b3" criteria in the 2021 LCRR to specify that the water system cannot have State-designated OWQPs. Under the 2021 LCRR and LCRI, the initial monitoring period refer to the first monitoring period under 2021 LCRR or LCRI.
[4] Systems that have conducted monitoring that meets the site location and sampling protocol between the date the rule was published in the *Federal Register* and three year can use that data to determine their sampling schedule in lieu of conducting initial monitoring.
[5] Under the LCRI, a system has a lead ALE if its 90th percentile level is above the new AL of 10 µg/L. The EPA has not modified the definition of a copper ALE (see note 1).
[6] Under the 2021 LCRR, a system has a lead TLE if its 90th percentile is above 10 µg/L but not above 15 µg/L.
[7] Systems with a lead 90th percentile level of ≤ 0.005 mg/L and copper 90th percentile level of ≤ 0.65 mg/L for 2 consecutive 6-month tap sampling monitoring periods can qualify for triennial monitoring at the reduced number of sites. Under the 2021 LCRR, lead and copper are evaluated separately, such that a system could qualify for to monitor for lead only at a triennial schedule but not copper or vice versa. In addition, under the 2021 LCRR and LCRI systems with CCT must also be in compliance with their OWQPs.

3.3.7.4 Discussion of Data Limitations and Uncertainty

As previously discussed, for systems serving 3,300 or fewer people, the pre-2021 LCR required States to only report those lead 90th percentile values that exceed the lead AL of 15 µg/L, but to report all lead 90th percentile values for larger water systems. To determine if systems in this smallest size category were underrepresented, the EPA estimated the percentage of systems with any reported lead 90th percentile data during 2012 - 2020 within this size category, as well as for systems serving 3,301 to 50,000 people and greater than 50,000 people. As shown in Column C of Exhibit 3-44 below, lead 90th percentile data were reported for about 72 percent of all CWSs in this smallest size category compared to more than 98 percent in the larger two categories. The EPA also estimated the percentage of CWSs in which only lead exceedance data were reported to try to assess any bias in reporting for the smallest size category. As shown in Column F of Exhibit 3-44, in general, both exceedances and non-exceedances were reported for approximately 98 percent of systems that reported any lead 90th percentile data in the smallest size category, and essentially all of those in the highest two categories. This indicates that most States report exceedance and non-exceedance data for even the smallest size category.

Exhibit 3-44: Estimated Number and Percentage of CWSs with Reported Lead ALEs Only under the Pre-2021 LCR (2012-2020)

System Size (Population Served)	All CWSs	All CWSs w/ any Reported Lead 90th Percentile Data		All CWSs w/ Reported P90 Data Above the Lead Action Level Only of 15 µg/L		
	Number	Number	Percent of All CWSs	Number	Percent of All CWSs that Only Report Lead ALEs	Percent of CWSs w/ Reported P90 Data that Only Report Lead ALEs
	A	B	C = B/A	D	E = D/A	F = D/B
≤ 3,300	40,113	29,046	72.41%	533	1.33%	1.84%
3,301 to 50,000	8,400	8,296	98.76%	1	0.01%	0.01%
> 50,000	1,016	997	98.13%	1	0.10%	0.10%
Total	**49,529**	**38,339**		**535**	**1.08%**	**1.40%**

Source: SDWIS/Fed, 4th quarter 2020 freeze. Also see, "Extent of P90 Data_LCR_Final.xlsx."

Notes:

General:

A: Includes all active CWSs in SDWIS/Fed based on fourth quarter 2020 freeze, current through December 31, 2020.

B: Includes CWSs with one or more P90 value reported to SDWIS/Fed during 2012- 2020.

C: Note, for the Proposed LCRI EA, the EPA used the most recent sample start date (*i.e.*, the date that denotes the start of the monitoring period). The EPA revised its approach for the Final LCRI EA to instead use the lowest value reported when a system reported more than one result in a single year that had the same sample start date. By using the minimum value versus the most recent, the EPA more accurately captured systems that only reported lead levels above the lead AL.

D: Includes the subset of CWSs for which all reported P90 values are above the pre-2021 LCR AL of 15 µg/L.

3.3.8 Water Quality Parameter Monitoring

Under the pre-2021 LCR, 2021 LCRR, and final LCRI, water systems can reduce the frequency, and in some cases the number of samples for WQP monitoring in the distribution system (also referred to as WQP tap monitoring) based on their 90th percentile lead levels and compliance with their OWQPs. Note that under all three versions of the LCR rule, systems cannot qualify for reduced WQP monitoring that occurs at entry points to the distribution system.

The EPA determined the initial WQP tap monitoring schedules under the pre-2021 LCR, the 2021 LCRR, and the final LCRI separately to reflect differences in the WQP monitoring requirements and 90th percentile calculations. The monitoring schedules presented in these sections are the estimated schedules that systems start with during the first period of cost modeling. Sections 3.3.8.1 and 3.3.8.2 describe the development of the WQP tap sampling schedules for the 2021 LCRR and the final LCRI, respectively. Also see Appendix B for a discussion of the derivation of the WQP tap monitoring schedules under the pre-2021 LCR. A discussion of data limitations and uncertainty associated with the analysis are provided in Section 3.3.8.3.

3.3.8.1 2021 LCRR

Under the 2021 LCRR, systems cannot conduct reduced WQP tap monitoring on a triennial schedule, as was allowed under the LCR. The 2021 LCRR also maintains the requirement for systems to conduct monitoring at entry points to the distribution system with no allowance for reduced entry point monitoring at a frequency less than every two weeks.

For modeling purposes, the EPA assumed the following to estimate a system's lead WQP tap monitoring schedule that starts in Year 4 of the 35-year period of analysis:

1. Systems serving 50,000 or fewer people are only required to conduct WQP monitoring under the following circumstances:
    - Six-month monitoring when they have a lead TLE and;
    - For two consecutive six-month monitoring periods after installation or re-optimization of CCT. These systems are not required to conduct long-term WQP monitoring to comply with OWQPs under the 2021 LCRR unless they are required by the State (not modeled) or have an ongoing lead TLE. Thus, the EPA assumed no systems serving 50,000 or fewer people would conduct WQP tap monitoring at a reduced rate.
2. Systems serving more than 50,000 people with CCT[71] and
    - A lead TLE would be on six-month routine WQP monitoring for as long as they exceed the TLE.
    - No lead TLE would be eligible for reduced WQP distribution monitoring. Eligibility is based on the water system meeting optimal water quality parameters (OWQPs).

[71] All systems serving more than 50,000 people were required to install CCT, except b3 systems. See Section 3.3.3 for an explanation of how the EPA derived the number of b3 systems.

3. The EPA used the lead 90th percentile classification, as described in Section 3.3.5.1.1, to determine if a system of any size has a TLE beginning in Year 4 of the rule analysis period.
4. The EPA modeled systems with a copper ALE separately.[72]

Exhibit 3-45 provides a summary of how the EPA used SDWIS/Fed data (current through December 31, 2020) to determine if a system serving more than 50,000 people without a lead TLE or copper ALE would qualify for reduced WQP tap monitoring based on compliance with OWQPs. Systems that do not meet the reduced monitoring criteria are assumed to monitor semi-annually at the standard number of sites (see Exhibit 4-19 in Chapter 4 for the number of standard and reduced WQP tap monitoring sites).

Exhibit 3-45: SDWIS/Fed Data Criteria Used to Determine Reduced WQP Tap Monitoring Schedules for Systems Serving > 50,000 People With CCT and No Lead TLE or Copper ALE

Monitoring Frequency	Criteria
6-Month (Reduced number of sites)[1]	System with CCT serves > 50,000 people and for ≥ 1 but < 3 years, it is in compliance with its OWQPs (*i.e.*, no 59 violation or a 59 violation for which the system has achieved compliance).[2]
Annual (Reduced number of sites)[1]	System with CCT serves > 50,000 people and for a minimum of 3 consecutive years, is in compliance with its OWQPs (*i.e.*, no 59 violation or a 59 violation for which the system has achieved compliance).[2]

Acronyms: CCT = corrosion control treatment; OWQP = optimal water quality parameters.
Notes:
[1] See Exhibit 4-19 in Chapter 4 for the number of distribution system sites required for reduced monitoring.
[2] Based on analysis of SDWIS/Fed data from 2012 through 2020. To meet the reduced monitoring criteria, systems with an OWQP violation must have achieved compliance, denoted by the SDWIS code of SOX or EOX by December 31, 2019.

Exhibit 3-46 and Exhibit 3-47 provide the percentage of CWSs serving more than 50,000 people with CCT and no lead TLE or copper ALE on each of the three possible WQP tap monitoring schedules under the 2021 LCRR by source water type based on analysis of SDWIS/Fed data for 2012 through 2020. For NTNCWSs, this information is provided in Exhibit 3-48 for SW systems. Note that no GW NTNCWS serves more than 50,000 people. Also, these exhibits exclude systems without CCT because WQP monitoring to comply with OWQPs is not required for these systems. The exhibits show that:

- All CWS GW systems and the majority of CWS SW systems (97.8 to 100%) serving more than 50,000 people met the criteria for annual reduced WQP tap monitoring.
- Of the two SW NTNCWSs that serve more than 50,000 people, one met the criteria for annual reduced WQP tap monitoring and the other is on six-month standard monitoring.

[72] As discussed in Chapter 4, Section 4.3.2.3.1, the SafeWater LCR models copper WQP monitoring separately from the lead WQP monitoring. To avoid double counting the cost of WQP monitoring for systems experiencing both a copper ALE and a lead ALE simultaneously, the SafeWater LCR models the costs of copper and lead WQP monitoring separately and restricts copper WQP monitoring to systems with a copper ALE only (SafeWater input: *p_copper_ale*) and lead 90th percentile not greater than the lead AL.

Exhibit 3-46: Percentage of Ground Water CWSs Serving > 50,000 People with CCT and No Lead TLE or Copper ALE on Various WQP Distribution System Monitoring Schedules (Starting in the First Modeled Compliance Period Given 2021 LCRR Requirements)

System Size	6 Month (Standard)	6 Month (Reduced)	Annual (Reduced)
		p_wqp_six_red	*p_wqp_annual*
(Population Served)	A = 1- (B+C)	B	C
50,001-100,000	0.0%	0.0%	100.0%
100,001-1,000,000	0.0%	0.0%	100.0%
> 1 M	0.0%	0.0%	100.0%

Source: For additional information, see "WQP Schedules_CWS_LCRR_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.
Note: Percentages are based on OWQP violation and compliance data reported to SDWIS/Fed for 2012 – 2020 in the fourth quarter frozen 2020 dataset, current through December 31, 2020.

Exhibit 3-47: Percentage of Surface Water CWSs Serving > 50,000 People with CCT and No Lead TLE or Copper ALE on Various WQP Distribution System Monitoring Schedules (Starting in the First Modeled Compliance Period Given 2021 LCRR Requirements)

System Size	6 Month (Standard)	6 Month (Reduced)	Annual (Reduced)
		p_wqp_six_red	*p_wqp_annual*
(Population Served)	A = 1- (B+C)	B	C
50,001-100,000	1.1%	1.1%	97.8%
100,001-1,000,000	1.6%	0.0%	98.4%
> 1 M	0.0%	0.0%	100.0%

Source: For additional information, see "WQP Schedules_CWS_LCRR_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.
Note: Percentages are based on OWQP violation and compliance data reported to SDWIS/Fed for 2012 – 2020 in the fourth quarter frozen 2020 dataset, current through December 31, 2020.

Exhibit 3-48: Percent of Surface Water NTNCWSs Serving > 50,000 People with CCT and No Lead TLE or Copper ALE on Various WQP Distribution System Monitoring Schedules (Starting in the First Modeled Compliance Period Given 2021 LCRR Requirements)

System Size	6 Month (Standard)	6 Month (Reduced)	Annual (Reduced)
		p_wqp_six_red	*p_wqp_annual*
(Population Served)	A = 1- (B+C)	B	C
50,001-100,000	100.0%	0.0%	0.0%
100,001-1,000,000	0.0%	0.0%	100.0%
> 1 M			

Source: For additional information, see "WQP Schedules_NTNCWS_LCRR_Final.xlsx," available in the docket at

EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. Percentages are based on OWQP violation and compliance data reported to SDWIS/Fed for 2012 – 2020 in the fourth quarter frozen 2020 dataset, current through December 31, 2020.
2. The gray shaded cells denote that no SW NTNCWS serves more than 1 million people.

3.3.8.2 Final LCRI

Under the final LCRI, all systems serving more than 10,000 people with CCT, systems without CCT that serve 10,001 to 50,000 people that have a lead or copper ALE, and systems serving 10,000 or fewer people that have a lead or copper ALE must conduct WQP sampling at entry points to the distribution system and within the distribution system.[73] Systems serving more than 10,000 people with CCT can qualify for reduced WQP monitoring in the distribution system if for at least two consecutive six-month monitoring periods they are in compliance with their State-set OWQP ranges or minimums and their lead and copper 90th percentile levels are at or below the action levels of 10 µg/L and 1.3 mg/L, respectively. The number of consecutive monitoring periods in which a system meets its OWQPs determines if a system qualifies for reduced semi-annual or annual monitoring. Under the final LCRI, as maintained from the 2021 LCRR, systems cannot conduct reduced WQP tap monitoring on a triennial schedule. The final rule also maintains the requirement for systems to conduct monitoring at entry points to the distribution system with no allowance for reduced entry point monitoring at a frequency less than every two weeks.

For modeling purposes, the EPA applied the same approach for the LCRI as was used for the 2021 LCRR, as previously described in Section 3.3.8.1, with one exception. Systems serving 10,001 to 50,000 people with CCT must continue monitoring under the final LCRI irrespective of their lead 90th percentile level, comply with State-set OWQP ranges or minimums, and are eligible for reduced monitoring. Because historical SDWIS/Fed data on OWQP compliance is not available for these systems, the EPA assumed the percent of these systems that qualify for reduced monitoring would be the same as for systems serving 50,001 to 100,000 people.

Exhibit 3-49 and Exhibit 3-50 provide the percentage of CWSs with CCT and no lead or copper ALE on each of the three possible distribution system monitoring schedules under the final LCRI by source water type based on analysis of SDWIS/Fed data from 2012 through 2020. For NTNCWSs, this information is provided in Exhibit 3-51 and Exhibit 3-52. The exhibits show that:

- All GW CWSs and the majority of SW systems serving more than 10,000 people (97.8 to 100 percent) met the criteria for annual reduced WQP tap monitoring.
- All SW NTNCWSs serving 10,001 to 100,000 people will be on standard six-month monitoring and those serving more than 1 million people met the criteria for annual reduced WQP monitoring.

[73] The EPA set more stringent requirements under the LCRI for systems serving 10,001 to 50,000 people with CCT. These systems must continue WQP monitoring irrespective of their lead or copper 90th percentile level. Under the pre-2021 LCR and 2021 LCRR, these systems were only required to conduct WQP monitoring when they had a lead or copper ALE, unless required by the State.

Exhibit 3-49: Percent of Ground Water CWSs Serving > 10,000 People with CCT and No Lead or Copper ALE on Various WQP Distribution System Monitoring Schedules (Starting in the First Modeled Compliance Period Given Final LCRI Requirements)

System Size	6 Month (Standard)	6 Month (Reduced)	Annual (Reduced)
		p_wqp_six_red	*p_wqp_annual*
(Population Served)	A = 1- (B+C)	B	C
10,001-50,000	0.0%	0.0%	100.0%
50,001-100,000	0.0%	0.0%	100.0%
100,001-1,000,000	0.0%	0.0%	100.0%
> 1 M	0.0%	0.0%	100.0%

Source: For additional information, see "WQP Schedules_CWS_LCRI_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. Percentages are based on OWQP violation data reported to SDWIS/Fed for 2012 – 2020 in the fourth quarter frozen 2020 dataset, current through December 31, 2020.
2. Under the final LCRI, systems serving 10,001 to 50,000 people with CCT must conduct WQP monitoring irrespective of their lead 90th percentile levels. The EPA assumed that the same percent of these systems would qualify for reduced monitoring as systems serving 50,001 to 100,000 people.

Exhibit 3-50: Percentage of Surface Water CWSs Serving > 10,000 People with CCT and No Lead or Copper ALE on Various WQP Distribution System Monitoring Schedules (Starting in the First Modeled Compliance Period Given Final LCRI Requirements)

System Size	6 Month (Standard)	6 Month (Reduced)	Annual (Reduced)
		p_wqp_six_red	*p_wqp_annual*
(Population Served)	A = 1- (B+C)	B	C
10,001-50,000	1.1%	1.1%	97.8%
50,001-100,000	1.1%	1.1%	97.8%
100,001-1,000,000	1.6%	0.0%	98.4%
> 1 M	0.0%	0.0%	100.0%

Source: For additional information, see "WQP Schedules_CWS_LCRI_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. Percentages are based on OWQP violation data reported to SDWIS/Fed for 2012 – 2020 in the fourth quarter frozen 2020 dataset, current through December 31, 2020.
2. Under the final LCRI, systems serving 10,001 to 50,000 people with CCT must conduct WQP monitoring irrespective of their lead 90th percentile levels. The EPA assumed that the same percent of these systems would qualify for reduced monitoring as systems serving 50,001 to 100,000 people.

Exhibit 3-51: Percentage of Ground Water NTNCWSs Serving > 10,000 People with CCT and No Lead or Copper ALE on Various WQP Distribution System Monitoring Schedules (Starting in the First Modeled Compliance Period Given Final LCRI Requirements)

System Size	6 Month (Standard)	6 Month (Reduced)	Annual (Reduced)
		p_wqp_six_red	*p_wqp_annual*
(Population Served)	A = 1- (B+C)	B	C
10,001-50,000	100.0%	0.0%	0.0%
50,001-100,000			
100,001-1,000,000			
> 1 M			

Source: For additional information, see "WQP Schedules_NTNCWS_LCRI_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. This table includes the monitoring schedules for SW NTNCWSs serving more than 10,000 people with CCT that did not have a lead or copper ALE based on data reported to SDWIS/Fed for 2012 – 2020 in the fourth quarter frozen 2020 dataset, current through December 31, 2020.
2. Under the final LCRI, systems serving 10,001 to 50,000 people with CCT must conduct WQP monitoring irrespective of their lead 90th percentile levels. There was insufficient data to estimate monitoring schedules based on SDWIS/Fed for this size category and no data for NTNCWS serving more than 50,000 people (see note 3) on which to base the WQP tap monitoring schedule. Thus, the EPA conservatively assumed these systems would be on semi-annual standard monitoring.
3. The gray shaded cells denote that no GW NTNCWS serve more than 50,000 people.

Exhibit 3-52: Percentage of Surface Water NTNCWSs Serving > 10,000 People with CCT and No Lead or Copper ALE on Various WQP Distribution System Monitoring Schedules (Starting in the First Modeled Compliance Period Given Final LCRI Requirements)

System Size	6 Month (Standard)	6 Month (Reduced)	Annual (Reduced)
		p_wqp_six_red	*p_wqp_annual*
(Population Served)	A = 1- (B+C)	B	C
10,001-50,000	100.0%	0.0%	0.0%
50,001-100,000	100.0%	0.0%	0.0%
100,001-1,000,000	0.0%	0.0%	100.0%
> 1 M			

Source: For additional information, see "WQP Schedules_NTNCWS_LCRI_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

1. This table includes the monitoring schedules for SW CWSs serving more than 10,000 people with CCT that did not have a lead or copper ALE based on data reported to SDWIS/Fed for 2012 – 2020 in the fourth quarter frozen 2020 dataset, current through December 31, 2020.
2. Under the final LCRI, systems serving 10,001 to 50,000 people with CCT must conduct WQP monitoring irrespective of their lead 90th percentile levels. There was insufficient data to estimate monitoring schedules based on SDWIS/Fed for this size category so the EPA assumed these systems would be on the same schedule as systems serving 50,001 to 100,000 people.

3. The gray shaded cells denote that no SW NTNCWS serve more than 1M people.

3.3.8.3 Discussion of Data Limitations and Uncertainty

To estimate the WQP monitoring schedules for the 2021 LCRR, starting in Year 4, the EPA assumed systems serving 50,000 or fewer people with CCT would discontinue WQP monitoring when they no longer exceeded the lead TL. Similarly, the EPA assumed for the final LCRI, systems serving 10,000 or fewer with CCT would discontinue WQP monitoring when they no longer exceeded the lead AL. Thus, these systems would never conduct reduced WQP tap monitoring. There may be uncertainty in these assumptions because some States may have required these smaller systems to continue to conduct long-term WQP monitoring and comply with OWQPs regardless of whether they exceeded the lead TL or AL, to ensure CCT is operating properly.

For the final LCRI, the EPA assumed that systems serving 10,001 to 50,000 with CCT and with no ALE would have the same likelihood of achieving reduced monitoring status as systems serving 50,001 to 100,000 based on analysis of historical SDWIS/Fed data from 2012 to 2020. If there exists some systematic difference between systems' ability to achieve OWQP set by States, in the 10,001 to 50,000 and 50,001 to 100,000 size categories, this assumption could result in an under- or overestimate of WQP monitoring costs.

3.3.9 Source and Treatment Changes

This section presents the EPA's methodology for estimating the annual likelihood that a system will add a new source or change treatment. Under the pre-2021 LCR, systems that conduct lead and copper tap sampling less frequently than semi-annually had to report plans to add a source or make a long-term treatment change to the State and obtain approval prior to making this change. The State could require systems to conduct additional monitoring or take other actions it deemed appropriate in response to this change. Under the 2021 LCRR and final LCRI, these requirements would apply to any system regardless of its monitoring schedule.

3.3.9.1 Source Change

The EPA used historical data from SDWIS/Fed reported through December 31, 2020 to estimate the likelihood that systems would have a source change in any given year. SDWIS/Fed assigns a unique facility ID for each source in a system. A change in source was defined as the addition of a facility ID for a system that was not present in the year before. The EPA evaluated source changes between 2013 and 2020.[74] Note that the addition of multiple facilities was considered a single change in source if they all occurred in the same calendar year. Only systems that had facility IDs listed in all years of the analysis (2013-2020) were included in the analysis.

The percentage of CWSs that had a change in source was calculated for each year interval from 2013 to 2020 (*i.e.,* 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018, 2018-2019, and 2019-2020). The values were then averaged across the seven individual year sequences. These estimates are shown in

[74] The EPA expanded the analysis period from proposed LCRI EA (USEPA, 2023b) from 2017 – 2020 to 2013 – 2020 to be more consistent with other analyses (data for 2012 was not available). Based on the expanded analysis, the estimated percentage of CWSs that will add a new source annually increased from 3.43 to 3.88 percent and for NTNCWSs, from 1.58 to 2.78 percent.

Exhibit 3-53 and Exhibit 3-54 for CWSs and NTNCWSs, respectively. Although most results are similar across CCT status and source water type, results for larger sized GW systems are high, likely due to the small total number of systems in those size categories.

To produce estimates that can be used to predict future changes over a 30+ year time period, the EPA combined the size categories. Specifically, the EPA calculated a weighted average using the number of CWSs in each stratum multiplied by their result to get an overall percentage for all systems of a given source water type and CCT status. In general, the estimates for CWSs were similar regardless of CCT status or source water type with the exception of those serving more than 50,000 people that ranged from about 7 to 48 percent and are based on a smaller number of systems in these size categories. The weighted averages for systems with and without CCT were 4.75 percent and 3.48 percent, respectively. Because of these similarities the EPA used one estimate of 3.88 percent across all CWSs in its cost estimates, which corresponds to the SafeWater LCR model data variable, *p_source_chng*.

Exhibit 3-53: Estimated Percent of CWSs that Will Add a New Source Each Year

Size Category (Population Served)	Estimated Percent of CWSs that Will Add a New Source (Based on 2013 – 2020 SDWIS/Fed Data) Source			
	With CCT		Without CCT	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	2.18%	3.31%	2.39%	3.35%
101-500	2.80%	2.96%	3.10%	2.91%
501-1,000	3.12%	3.07%	3.56%	3.01%
1,001-3,300	4.19%	3.44%	4.32%	3.08%
3,301-10,000	6.81%	4.71%	6.82%	4.77%
10,001-50,000	8.34%	5.62%	9.91%	5.96%
50,001-100,000	15.83%	8.78%	47.62%	7.14%
100,001-1M	23.34%	12.83%	14.29%	23.81%
>1M	42.86%	21.43%		
WEIGHTED AVERAGE	4.60%	4.91%	3.45%	3.67%
	4.75%		3.48%	
	3.88% *(p_source_chng)*			

Notes:

1. For additional information, see file "Likelihood_SourceChange_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.
2. The gray shaded cells denote that no CWSs without CCT serve more than 1 million people.

In general, the estimates for NTNCWSs were similar regardless of CCT status or source water type with two exceptions. The EPA estimated that 10.71 percent of NTNCWSs with CCT using SW and serving 3,001-10,000 and 12.09 of NTNCWSs without CCT using GW that serve 10,001 to 50,000 people would change their source each year. These high likelihoods are based on a small number of systems in each of these categories (*i.e.*, 8 and 13 systems, respectively). Thus, the EPA combined size categories for NTNCWSs and estimated a weighted average for each CCT and source stratum, for those with and

without CCT and all NTNCWSs. The combined weighted averages by CCT status and for all NTNCWSs yield an estimate of 2.78 percent (*p_source_chng*).

Exhibit 3-54: Estimated Percent of NTNCWS that Will Change Source Each Year

Size Category (Population Served)	Estimated Percent of NTNCWSs that Will Add a New Source (Based on 2013 – 2020 SDWIS Data)			
	With CCT		Without CCT	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	2.90%	3.73%	2.51%	5.34%
101-500	3.16%	2.04%	2.71%	3.63%
501-1,000	2.74%	1.43%	2.54%	3.65%
1,001-3,300	5.35%	4.95%	3.45%	2.42%
3,301-10,000	3.73%	10.71%	4.55%	1.59%
10,001-50,000	4.76%	0.00%	12.09%	4.76%
50,001-100,000		0.00%		
100,001-1M		0.00%		
>1M				
WEIGHTED AVERAGE	3.21%	3.40%	2.66%	3.97%
	3.22%		2.71%	
	2.78% *(p_source_chng)*			

Notes:

1. For additional information, see file "Likelihood_SourceChange_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.
2. The gray shaded cells denote that for NTNCWSs with CCT, no GW NTNCWSs serve more than 50,000 people and no SW NTNCWSs serve more than > 1 million people. For those without CCT, none serve more than 50,000 people, regardless of their water source.

3.3.9.1.1 Discussion of Data Limitations and Uncertainty

Although SDWIS/Fed provides the most comprehensive dataset of available system information, the reporting of source information to SDWIS/Fed has associated uncertainties. See Section 3.2.1 for a discussion of SDWIS/Fed. The EPA worked to minimize the impacts of these uncertainties by counting only non-emergency sources, net increases in the number of sources, averaging results over three two-year periods, and combining size categories to minimize over-representation of small numbers of large systems in a single size category in order to develop a more representative prediction of changes throughout the rule analysis period for all water systems in the United States. The EPA recognizes that using SDWIS/Fed may underestimate the percent of systems changing sources because it does not include systems that add and subtract the same type of source in a given calendar year.

3.3.9.2 Primary Source Change

The EPA assumed States at a minimum would require systems that change their primary source to take additional actions such as source water monitoring. The EPA defined a change in primary source as a year-to-year change in purchasing status and/or source type. Changes in primary source were evaluated

at the facility level, so that each system/facility combination was counted as a distinct change. New systems that were not in SDWIS/Fed during the entire evaluation period of 2013 -2020 were excluded from the analysis.[75] Specifically, a change in primary source includes the following options:

- Change from a system that receives or purchases some or all of its finished water from a wholesale system to one that uses its own source or vice versa but continues to use GW, SW, or ground water under the direct influence of surface water (GU, shortened from GUDWI). For example, changes from GW purchased to GW, SW to SW purchased.
- Change from GW to SW or GU; from SW to GW or GU; or GU to GW or SW.
- Change in source type and purchased status, *e.g.*, from GW purchased to SW, GU to SW purchased.

The counts of systems meeting these criteria based on information in SDWIS/Fed for 2013 to 2020 were small for both CWSs (4,660 system/facility combinations) and NTNCWSs (145 system/facility combinations). This is expected since changing source water type would change the overall water chemistry significantly and affect numerous regulatory requirements. The EPA estimated that 0.42 percent and 0.10 percent of CWSs and NTNCWSs, respectively, would change primary source water each year. For additional information, see "Likelihood_SourceChange_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov. However, for reasons cited in the next section, the EPA assumed that one percent of CWSs and NTNCWSs would change their primary source (*p_source_sig*).

3.3.9.2.1 Discussion of Data Limitations and Uncertainty

The EPA estimate of one percent of systems changing their primary source water type in a given year over the rule analysis period is uncertain given that the agency is using historical data to predict future rates of change. The EPA found that very few systems, less than one percent, changed primary source water designation as reported to SDWIS/Fed between 2013 and 2020. However, the EPA believes that a baseline rate of change of one percent is a reasonable predictor of future changes allowing for the potential increases in source water type changes due to population movement, GW quality changes, drought, and other climate-related factors.

3.3.9.3 Treatment Change

The EPA used historical data from SDWIS/Fed to estimate the percent of systems that would change treatment in a given year. For this analysis, the EPA identified a treatment change as a system adding a treatment that was not used in the previous year.

The analysis was limited to:

- Treatment changes that were associated with non-emergency sources.
- Treatment code entries with a reported treatment code as opposed to a blank field or with a dash.

[75] As previously discussed in Section 3.3.9.1, the EPA modified the analysis period used in the proposed LCRI EA (USEPA, 2023b) from 2017 – 2020 to 2013 - 2020, but retained the assumption that 1 percent of systems would have a change in their primacy source each year.

- Systems that had at least one valid treatment code in all years of the analysis.
- Systems that did not also have a source change in a given year, to avoid double counting.
- Systems that were in SDWIS/Fed during the entire evaluation period of 2013 -2020.[76] Changes in treatment were identified for each 2-year sequence from 2013-2020. This yields a total of seven, 2-year sequences. These 2-year sequences include 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018, 2018-2019, and 2019-2020.

The estimated percent of systems that will change treatment each year is shown in Exhibit 3-55 and Exhibit 3-56 for CWSs and NTNCWSs, respectively. The percentages are the average of the annual percent of systems with a treatment change from 2013-2020. Similar to the approach taken for estimating source water changes, the EPA estimated the weighted average for CWSs by CCT status, source water type, and for all CWSs. The weighted average percentages are between three and seven percent considering only CCT status and not source type, with an overall weighted average of 4.2 percent, which corresponds to the value of the SafeWater model LCR data variable, *p_treat_change*.

The estimated percent of NTNCWSs that will change treatment each year is low across all size categories. The EPA estimated the weighted average for NTNCWSs by CCT status, source water type, and for all NTNCWSs. The weighted average percentages were between two and six percent considering only CCT status and not source type. The overall weighted average for NTNCWSs was 3.2 percent (*p_treat_change*).

[76] Similar to the analysis for the change in source water, the EPA also extended the analysis period from 2017 – 2020 in the proposed LCRI EA (USEPA, 2023b) to 2013 – 2020 to estimate the percentage of systems that would have a long-term change in treatment each year. Based on the 2013 – 2020 expanded analysis period, the percentage of systems with a treatment change decreased slightly from 4.6 to 4.2 percent for CWSs and from 3.3 to 3.2 percent for NTNCWSs.

Exhibit 3-55: Estimated Percent of CWSs that Will Change Treatment Each Year[1]

Size Category	Estimated Percent of CWSs that will Change Treatment (Based on 2013 – 2020 SDWIS Data)			
	With CCT		Without CCT	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	4.5%	7.7%	2.2%	5.6%
101-500	5.0%	5.3%	2.5%	3.9%
501-1,000	5.9%	4.6%	3.2%	6.2%
1,001-3,300	6.5%	5.5%	4.0%	5.3%
3,301-10,000	7.2%	7.6%	4.8%	6.6%
10,001-50,000	9.1%	7.8%	6.2%	7.1%
50,001-100,000	9.1%	9.6%	0.0%	0.0%
100,001-1,000,000	8.6%	11.8%	0.0%	14.3%
>1M	28.6%[2]	7.9%	0.0%	0.0%
WEIGHTED AVERAGE	6.1%	7.2%	2.9%	5.6%
	6.5%		3.2%	
	4.2% *(p_treat_change)*			

Note:

[1] For additional information, see file "Likelihood_TreatmentChange_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

[2] This percentage is based on a single system that had a treatment change in some but not all years.

Exhibit 3-56: Estimated Percent of NTNCWSs that Will Change Treatment Each Year

Size Category	Estimated Percent of NTNCWSs that Will Change Treatment (Based on 2013 – 2020 SDWIS Data)			
	With CCT		Without CCT	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	5.1%	12.2%	2.6%	3.2%
101-500	5.1%	4.8%	2.8%	4.2%
501-1,000	5.3%	8.6%	2.9%	4.3%
1,001-3,300	5.8%	6.7%	3.1%	4.6%
3,301-10,000	5.2%	8.6%	1.3%	7.7%
10,001-50,000	0.0%		4.8%	14.3%
50,001-100,000		0.0%		
100,001-1,000,000		0.0%		
>1M				
WEIGHTED AVERAGE	5.2%	7.4%	2.7%	4.3%
	5.3%		2.8%	
	3.2% *(p_treat_change)*			

Notes:

1. For additional information, see file "Likelihood_TreatmentChange_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

2. The gray shaded cells denote that for NTNCWSs with CCT, no GW NTNCWSs serve more than 50,000 people and no SW NTNCWSs serve more than > 1M people. For those without CCT, none serve more than 50,000 people, regardless of their water source.

3.3.9.3.1 Discussion of Data Limitations and Uncertainty

There is uncertainty in using counts of treatment codes from SDWIS/Fed to predict the future likelihood of treatment changes. In addition, there is uncertainty in how consistently States reported this information to SDWIS/Fed. Using an average rate from 2013 to 2020 may over or underrepresent costs across the final LCRI implementation period depending on future drinking water regulations and trends in source water quality. The EPA worked to minimize the impacts of these uncertainties by averaging results over three two-year periods and combining size categories to minimize over-representation of small numbers of large systems in a single size category in order to develop a more representative prediction of changes throughout the rule analysis period for all water systems in the United States.

3.3.10 Schools, Child Care Facilities, Local Health Departments, and Targeted Medical Providers

The pre-2021 LCR and 2021 LCRR require CWSs that exceed the lead AL to provide lead PE materials to facilities that include, but are not limited to schools, child care facilities, community-based organizations, and medical providers that offer services to pregnant women, children, and infants to better reach these at-risk populations and their caregivers. CWSs must also contact local health departments by phone or in person to request the health agency's support in disseminating information on lead in drinking water and the steps that vulnerable populations can take to reduce their exposure. These requirements are maintained under the final LCRI. Section 3.3.10.1 explains how the EPA derived the average number of each of these facility types per system.

The 2021 LCRR established requirements for CWSs to conduct PE and lead in drinking water testing in schools and licensed child care facilities in their service area. Consistent with the 2021 LCRR, the final LCRI requires CWSs to conduct drinking water monitoring in schools and child care facilities as follows:

- Sample for lead in schools and licensed child care facilities served by the CWS unless they were constructed or had full plumbing replacement on or after January 1, 2014 or the date the State adopted standards that meet the definition of lead free in accordance with Section 1417 of the SDWA, as amended by the Reduction of Lead in Drinking Water Act and are not served by a lead, GRR, or unknown service line. This requirement does not apply to a school or child care facility that is regulated as a public water system.

- During the first five years after the final LCRI compliance date (first five-year cycle), conduct monitoring at a minimum of 20 percent of the elementary schools and 20 percent of the licensed child care facilities they serve per year. CWSs are required to schedule sampling with elementary schools and licensed child care facilities and may count schools or licensed child care facilities that decline sampling or are non-responsive towards the minimum 20 percent. Secondary schools are sampled when requested. After the first five-year cycle, conduct monitoring only at schools and licensed child care facilities that request testing.

- Collect five samples for lead per school and two samples per child care facility. Samples must be 250-mL in volume with a stagnation time of 8 -18 hours.

- Provide sampling results to tested facilities, States, and local and State health departments.
- Provide a more in-depth annual report to the State.

The 2021 LCRR and final LCRI allows States to waive school and/or licensed child care facility sampling requirements for individual CWSs under the following conditions:

- The State or locality has an existing program or the facility or district has a policy that meets all of the requirement in the LCRR/LCRI;
- The State or locality has an existing program or the facility or district has a policy that meets all of the requirement in the LCRR/LCRI except its program uses a different sample volume for testing or stagnation time but requires remediation actions in response to a high lead level (e.g., disconnecting or replacing affected fixtures and installation of POU devices);
- The State or locality has an existing program or the facility or district has a policy that meets all the requirements in the LCRR/LCRI except its program samples less frequently than once every five years but requires remediation actions in response to a high lead level; or
- The sampling was conducted under the Water Infrastructure Improvements for the Nation Act (WIIN Act) Grant Program for Lead Testing in School and Child Care Program Drinking Water and therefore was consistent with the grant requirements.

New under the final LCRI, States can also waive CWSs from sampling a school or child care facility that installs and maintains POU devices that are certified by an ANSI-accredited certifier to reduce lead on all outlets used to provide water for human consumption.

The final LCRI expands the eligibility of waivers to allow States to waive requirements for the first five-year sampling cycle after the final LCRI compliance date in schools and licensed child care facilities that were sampled between January 1, 2021 and the final LCRI compliance date. The 2021 LCRR does not allow States to waive requirements based on sampling conducted prior to the LCRR compliance date of October 16, 2024.

3.3.10.1 Estimated Number of Facilities

This section is organized into four subsections as follows:

- 3.3.10.1.1: Schools
- 3.3.10.1.2: Child Care Facilities
- 3.3.10.1.3: Local Health Agencies and Targeted Medical Providers
- 3.3.10.1.4: Discussion of Data Limitations and Uncertainty

Schools and child care facilities that are NTNCWSs are not served by CWSs and have separate PE requirements and, under the final LCRI, would not be included in the CWS's lead in drinking water monitoring required at schools and licensed child care facilities. Thus, as shown below they are excluded from the estimated number of schools and child care facilities provided in Sections 3.3.10.1.1 and 3.3.10.1.2, respectively. Also, for additional detail, see file, "School_Child Care Inputs_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

3.3.10.1.1 Schools

The EPA used the following approach to estimate the total number of public and private elementary and secondary schools per State and United States territory and for the Navajo Nation:

1. Obtained the most current estimate of public elementary and secondary schools per State and United States territory from the United States Department of Education, NCES (NCES, 2020a). Categorized combined elementary/secondary schools and schools that did not report a grade span as elementary schools. Obtained the most current estimate of private schools per State from the NCES Private School Universe Survey (NCES, 2020b) and used the ratio of the numbers of elementary and secondary public schools to estimate the proportion of private schools that are elementary vs. secondary. Supplemented NCES data with data from other sources to estimate the number of public and private schools in the Navajo Nation and the number of private schools in United States territories.

2. Determined the number of NTNCWSs that are schools in each State and United States territory based on the system's reported service area type code for schools of "SC" in SDWIS/Fed fourth quarter 2020 frozen dataset. Used the owner type information to determine how many schools were public vs. private. Used the ratio of elementary and secondary schools for all public schools from NCES (NCES, 2020a) to estimate the proportion of NTNCWSs that are elementary vs. secondary.

3. Subtracted the number of public and private NTNCWSs schools per State and United States territory calculated in Step 2 from the national number of public and private elementary and secondary schools per State and United States territories estimated in Step 1 to produce the adjusted number of schools served by CWSs.

Exhibit 3-57 (presented following the description of the estimated child care facilities) shows the results of these steps in columns A through F.

3.3.10.1.2 Child Care Facilities

The EPA used a similar approach to the one used for schools to estimate the average number of child care facilities per CWS:

1. Obtained the national number of "organized" child care facilities[77] per State from *Figure 24, U.S. Child Care Industry Statistics* (CED, 2019). Note that the CED study utilized data collected in 2017; therefore, the estimated total number of child care facilities in 2017 was 674,332. The EPA supplemented CED data with additional web-based information on the number of child care facilities in the Navajo Nation and in United States territories. See the file "School_Child Care Inputs_Final.xlsx" for details.

2. Determined the number of NTNCWSs that are child care facilities in each State and United States territories based on the system's reported service area type code for Daycare Center of "DC" in SDWIS/Fed fourth quarter 2020 frozen dataset.

[77] Organized child care providers are those who typically offer care on a paid basis.

3. Subtracted the number of NTNCWS child care facilities per State and United States territory calculated in Step 2 from the national number of child care facilities per State and United States territory, Step 1, to produce the adjusted number of child care facilities served by CWSs.

   Exhibit 3-57 shows the results of these steps in Column G.

Exhibit 3-57: Number of Schools and Child Care Facilities by State and United States Territory, Adjusted to Remove NTNCWS Schools and Child Care Facilities

States/ Territories/Tribes	Public Schools (adjusted to remove NTNCWSs)			Private Schools (adjusted to remove NTNCWSs)			Number of Child Care Facilities (adjusted to remove NTNCWSs)
	Total	Secondary	Elementary	Total	Secondary	Elementary	
	A	B	C	D	E	F	G
United States (incl D.C.)	95,469	23,098	72,371	28,564	6,635	21,929	673,084
United States (incl D.C.)/Territories/ Tribes	**96,691**	**23,350**	**73,341**	**29,221**	**6,765**	**22,456**	**673,542**
Alabama	1,528	399	1,129	403	105	298	7,163
Alaska	438	67	371	31	5	26	1,532
Arizona	2,286	748	1,538	394	129	265	11,432
Arkansas	1,078	370	708	170	59	111	5,186
California	10,095	2,409	7,686	3,153	752	2,401	95,126
Colorado	1,875	374	1,501	344	69	275	9,017
Connecticut	926	199	727	290	62	228	7,775
Delaware	222	38	184	127	22	105	1,384
Dist. of Columbia	228	38	190	72	12	60	1,299
Florida	4,111	640	3,471	2,451	382	2,069	34,510
Georgia	2,274	450	1,824	837	166	671	22,967
Hawaii	292	53	239	164	30	134	1,209
Idaho	708	183	525	131	34	97	2,769
Illinois	4,245	998	3,247	1,211	285	926	40,943
Indiana	1,772	419	1,353	828	196	632	12,514
Iowa	1,300	338	962	210	55	155	11,584

States/ Territories/Tribes	Public Schools (adjusted to remove NTNCWSs)			Private Schools (adjusted to remove NTNCWSs)			Number of Child Care Facilities (adjusted to remove NTNCWSs)
	Total	Secondary	Elementary	Total	Secondary	Elementary	
	A	B	C	D	E	F	G
Kansas	1,304	338	966	210	54	156	7,751
Kentucky	1,531	482	1,049	408	128	280	6,430
Louisiana	1,372	282	1,090	403	83	320	9,855
Maine	448	109	339	79	19	60	2,585
Maryland	1,285	217	1,068	631	107	524	14,189
Massachusetts	1,776	360	1,416	633	128	505	10,436
Michigan	3,730	946	2,784	348	88	260	19,121
Minnesota	2,476	825	1,651	503	168	335	15,787
Mississippi	1,053	334	719	181	57	124	8,654
Missouri	2,364	632	1,732	621	166	455	13,004
Montana	730	281	449	98	38	60	2,084
Nebraska	1,054	326	728	189	58	131	6,671
Nevada	695	130	565	128	24	104	5,513
New Hampshire	370	82	288	165	37	128	1,647
New Jersey	2,411	497	1,914	977	201	776	16,322
New Mexico	860	230	630	158	42	116	2,679
New York	4,663	1,080	3,583	1,542	357	1,185	63,992
North Carolina	2,557	530	2,027	723	150	573	15,552
North Dakota	534	180	354	57	19	38	2,890
Ohio	3,526	951	2,575	1,130	305	825	21,429
Oklahoma	1,786	558	1,228	173	54	119	6,019
Oregon	1,130	247	883	345	76	269	8,781

States/ Territories/Tribes	Public Schools (adjusted to remove NTNCWSs)			Private Schools (adjusted to remove NTNCWSs)			Number of Child Care Facilities (adjusted to remove NTNCWSs)
	Total	Secondary	Elementary	Total	Secondary	Elementary	
	A	B	C	D	E	F	G
Pennsylvania	2,650	685	1,965	2,398	619	1,779	16,881
Rhode Island	298	66	232	105	23	82	1,672
South Carolina	1,253	283	970	409	92	317	8,018
South Dakota	712	231	481	78	25	53	2,825
Tennessee	1,856	368	1,488	564	112	452	13,185
Texas	8,899	2,017	6,882	1,701	385	1,316	56,358
Utah	1,058	281	777	167	44	123	4,970
Vermont	202	41	161	80	16	64	1,699
Virginia	1,948	401	1,547	958	197	761	15,847
Washington	2,408	625	1,783	660	171	489	9,763
West Virginia	701	135	566	124	24	100	2,307
Wisconsin	2,096	526	1,570	762	191	571	10,399
Wyoming	355	96	259	40	11	29	1,359
Puerto Rico	846	159	687	565	106	459	228
Guam	44	7	37	22	4	19	41
United States Virgin Islands[1]	6	2	4	0	0	0	137
American Samoa	29	6	23	15	3	12	22
North Mariana Islands	20	11	9	15	8	7	13
Navajo Nation	277	67	210	40	10	30	17

Source: "School_Child Care Inputs_Final.xlsx," worksheet "Adjusted Sch & CC by State", Table 1.

Exhibit 3-58, is a continuation of Exhibit 3-57, and includes the number of schools and child care facilities per person served by a CWS in each State. The SafeWater LCR model applies the number of schools per person served by a CWS per State, to estimate the number of:

- Public elementary schools per system that corresponds to SafeWater LCR model data variable, *numb_elem_schools pub* (see Column K);
- Private elementary schools per system that corresponds to SafeWater LCR model data variable, *numb_elem_schools priv* (see Column N);
- Public secondary schools per system that corresponds to SafeWater LCR model data variable, *numb_second_schools* pub (see Column J);
- Private secondary schools per system that corresponds to SafeWater LCR model data variable, *numb_second_schools priv* (see Column M); and
- Child care facilities per system that corresponds to SafeWater LCR model data variable, *numb_daycares* (see Column O).

For example, assume a model CWS in Virginia serves 15,000 people. To determine the number of public secondary schools for this water system, the CWS population of 15,000 is multiplied by the number of public secondary schools per person served by a CWS in Virginia from Column J of Exhibit 3-58 (0.000056)[78], which equals 0.84 public secondary schools.

[78] The number of secondary schools per person in Virginia, 0.000056, is derived by dividing the number of public secondary schools in Virginia from Column B of Exhibit 3-60 (401) by the total Virginia population served by all CWSs in the State from Column H of Exhibit 3-61 (7,114,191).

Exhibit 3-58: Number of Schools per Person Served by a CWS per State, all Categories, Adjusted to Remove NTNCWS Schools and Child Care Facilities

States/Territories/ Tribes	Total Population Served by CWSs	Estimated Public Schools per Person Served by a CWS			Estimated Private Schools per Person Served by a CWS			Estimated Child Care Facilities per Person Served by a CWS
		Public Schools TOTAL	Public Schools SECONDARY	Public Schools ELEMENTARY	Private Schools TOTAL	Private Schools SECONDARY	Private Schools ELEMENTARY	
	H	I = A / H	J = B / H	K = C / H	L = D / H	M = E / H	N = F / H	O = G / H
United States (incl D.C.)	309,061,248	0.000309	0.000075	0.000234	0.000092	0.000021	0.000071	0.002178
United States (incl D.C.)/Territories/ Tribes	**313,044,551**	**0.000309**	**0.000075**	**0.000234**	**0.000093**	**0.000022**	**0.000072**	**0.002152**
Alabama	5,949,334	0.000257	0.000067	0.000190	0.000068	0.000018	0.000050	0.001204
Alaska	689,487	0.000635	0.000098	0.000538	0.000045	0.000007	0.000038	0.002222
Arizona	6,727,375	0.000340	0.000111	0.000229	0.000059	0.000019	0.000039	0.001699
Arkansas	2,938,783	0.000367	0.000126	0.000241	0.000058	0.000020	0.000038	0.001765
California	39,960,569	0.000253	0.000060	0.000192	0.000079	0.000019	0.000060	0.002380
Colorado	6,533,948	0.000287	0.000057	0.000230	0.000053	0.000011	0.000042	0.001380
Connecticut	2,776,268	0.000334	0.000072	0.000262	0.000104	0.000022	0.000082	0.002801
Delaware	937,477	0.000237	0.000041	0.000196	0.000135	0.000023	0.000112	0.001476
Dist. of Columbia	664,597	0.000343	0.000057	0.000286	0.000108	0.000018	0.000090	0.001955
Florida	20,533,551	0.000200	0.000031	0.000169	0.000119	0.000019	0.000101	0.001681
Georgia	9,549,632	0.000238	0.000047	0.000191	0.000088	0.000017	0.000070	0.002405

States/Territories/ Tribes	Total Population Served by CWSs	Estimated Public Schools per Person Served by a CWS			Estimated Private Schools per Person Served by a CWS			Estimated Child Care Facilities per Person Served by a CWS
		Public Schools TOTAL	Public Schools SECONDARY	Public Schools ELEMENTARY	Private Schools TOTAL	Private Schools SECONDARY	Private Schools ELEMENTARY	
	H	I = A / H	J = B / H	K = C / H	L = D / H	M = E / H	N = F / H	O = G / H
Hawaii	1,507,465	0.000194	0.000035	0.000159	0.000109	0.000020	0.000089	0.000802
Idaho	1,365,170	0.000519	0.000134	0.000384	0.000096	0.000025	0.000071	0.002028
Illinois	12,028,786	0.000353	0.000083	0.000270	0.000101	0.000024	0.000077	0.003404
Indiana	4,980,984	0.000356	0.000084	0.000272	0.000166	0.000039	0.000127	0.002512
Iowa	2,849,783	0.000456	0.000119	0.000338	0.000074	0.000019	0.000055	0.004065
Kansas	2,821,989	0.000462	0.000120	0.000342	0.000074	0.000019	0.000055	0.002747
Kentucky	4,497,262	0.000340	0.000107	0.000233	0.000091	0.000029	0.000062	0.001430
Louisiana	5,004,321	0.000274	0.000056	0.000218	0.000081	0.000017	0.000064	0.001969
Maine	680,244	0.000659	0.000161	0.000498	0.000116	0.000028	0.000088	0.003800
Maryland	5,371,635	0.000239	0.000040	0.000199	0.000117	0.000020	0.000098	0.002641
Massachusetts	9,725,252	0.000183	0.000037	0.000146	0.000065	0.000013	0.000052	0.001073
Michigan	7,410,236	0.000503	0.000128	0.000376	0.000047	0.000012	0.000035	0.002580
Minnesota	4,524,951	0.000547	0.000182	0.000365	0.000111	0.000037	0.000074	0.003489
Mississippi	3,079,305	0.000342	0.000108	0.000233	0.000059	0.000019	0.000040	0.002810
Missouri	5,418,783	0.000436	0.000117	0.000320	0.000115	0.000031	0.000084	0.002400
Montana	770,369	0.000948	0.000365	0.000583	0.000127	0.000049	0.000078	0.002705
Nebraska	1,588,421	0.000664	0.000205	0.000459	0.000119	0.000037	0.000082	0.004200
Nevada	2,847,531	0.000244	0.000046	0.000198	0.000045	0.000008	0.000037	0.001936
New Hampshire	895,785	0.000413	0.000092	0.000321	0.000184	0.000041	0.000143	0.001839

States/Territories/ Tribes	Total Population Served by CWSs	Estimated Public Schools per Person Served by a CWS			Estimated Private Schools per Person Served by a CWS			Estimated Child Care Facilities per Person Served by a CWS
		Public Schools TOTAL	Public Schools SECONDARY	Public Schools ELEMENTARY	Private Schools TOTAL	Private Schools SECONDARY	Private Schools ELEMENTARY	
	H	I = A / H	J = B / H	K = C / H	L = D / H	M = E / H	N = F / H	O = G / H
New Jersey	8,845,156	0.000273	0.000056	0.000216	0.000110	0.000023	0.000088	0.001845
New Mexico	2,077,412	0.000414	0.000111	0.000303	0.000076	0.000020	0.000056	0.001290
New York	18,251,232	0.000255	0.000059	0.000196	0.000084	0.000020	0.000065	0.003506
North Carolina	8,820,387	0.000290	0.000060	0.000230	0.000082	0.000017	0.000065	0.001763
North Dakota	738,289	0.000723	0.000243	0.000480	0.000077	0.000026	0.000051	0.003914
Ohio	10,486,511	0.000336	0.000091	0.000246	0.000108	0.000029	0.000079	0.002043
Oklahoma	3,703,121	0.000482	0.000151	0.000332	0.000047	0.000015	0.000032	0.001625
Oregon	3,517,136	0.000321	0.000070	0.000251	0.000098	0.000021	0.000077	0.002497
Pennsylvania	11,425,462	0.000232	0.000060	0.000172	0.000210	0.000054	0.000156	0.001477
Rhode Island	1,035,889	0.000288	0.000064	0.000224	0.000101	0.000022	0.000079	0.001614
South Carolina	4,080,458	0.000307	0.000069	0.000238	0.000100	0.000023	0.000078	0.001965
South Dakota	853,073	0.000835	0.000271	0.000564	0.000091	0.000030	0.000062	0.003312
Tennessee	7,193,174	0.000258	0.000051	0.000207	0.000078	0.000016	0.000063	0.001833
Texas	28,670,617	0.000310	0.000070	0.000240	0.000059	0.000013	0.000046	0.001966
Utah	3,280,153	0.000323	0.000086	0.000237	0.000051	0.000014	0.000037	0.001515
Vermont	449,956	0.000449	0.000092	0.000357	0.000178	0.000036	0.000141	0.003776
Virginia	7,114,191	0.000274	0.000056	0.000218	0.000135	0.000028	0.000107	0.002228
Washington	7,743,099	0.000311	0.000081	0.000230	0.000085	0.000022	0.000063	0.001261
West Virginia	1,527,381	0.000459	0.000088	0.000370	0.000081	0.000016	0.000066	0.001510

States/Territories/ Tribes	Total Population Served by CWSs	Estimated Public Schools per Person Served by a CWS			Estimated Private Schools per Person Served by a CWS			Estimated Child Care Facilities per Person Served by a CWS
		Public Schools TOTAL	Public Schools SECONDARY	Public Schools ELEMENTARY	Private Schools TOTAL	Private Schools SECONDARY	Private Schools ELEMENTARY	
	H	I = A / H	J = B / H	K = C / H	L = D / H	M = E / H	N = F / H	O = G / H
Wisconsin	4,119,398	0.000509	0.000128	0.000381	0.000185	0.000046	0.000139	0.002524
Wyoming	499,860	0.000710	0.000192	0.000519	0.000080	0.000022	0.000058	0.002719
Puerto Rico	3,415,890	0.000248	0.000046	0.000201	0.000165	0.000031	0.000134	0.000067
Guam	191,786	0.000229	0.000036	0.000193	0.000115	0.000018	0.000096	0.000214
U.S. Virgin Islands	81,072	0.000074	0.000026	0.000048	0.000000	0.000000	0.000000	0.001690
American Samoa	56,728	0.000511	0.000106	0.000405	0.000264	0.000055	0.000210	0.000388
North Mariana Islands	65,949	0.000303	0.000167	0.000136	0.000227	0.000125	0.000102	0.000197
Navajo Nation	171,878	0.001612	0.000390	0.001222	0.000233	0.000056	0.000176	0.000099

Source: “School_Child Care Inputs_Final.xlsx,” worksheet “Adjusted Sch & CC by State”, Table 2.

3.3.10.1.3 Local Health Agencies and Targeted Medical Providers

The EPA used the following approach to estimate the average number of local health agencies and targeted medical providers per CWS:

1. Determined the total number of local health agencies and targeted medical providers by summing the numbers of local health agencies, obstetrician/gynecologists (ob/gyns), pediatricians, and family medicine physicians, which were obtained from various data sources:
   a. The number of local health agencies was obtained from data collected by the NACCHO in the 2019 National Profile of Local Health Departments (NACCHO, 2019). The estimated number of local health agencies in 2019 was 2,459.[79]
   b. The number of ob-gyns (20,700), pediatricians (30,200), and family medicine physicians (107,700) is from the U.S. Bureau of Labor Statistics' "Occupational Outlook Handbook" (U.S. Bureau of Labor Statistics, 2021), as previously discussed in Section 3.2.8.
2. Assumed the number of local health agencies and targeted medical providers were proportionally distributed across the size categories. For example, as previously discussed, the percentage of the people served by smallest size category of CWSs is approximately 0.23 percent of the total population served by CWSs (*i.e.*, 708,236/313,044,551). The 0.23 percent was multiplied by the number of health agencies and targeted medical providers to yield an estimated number of health agencies and targeted medical providers served by all systems in this size category (0.23%*161,059 = 364).
3. Divided the number of health agencies and targeted medical providers in each of the nine system size categories by the number of systems in the category.
4. Rounded up values to the nearest whole number. The EPA assumed all CWSs would contact at least one agency because the pre-2021 LCR requires CWSs to contact local public health agencies even if they are outside their service area. Exhibit 3-59 provides the average number of health agencies and targeted medical providers per CWSs.

[79] A 2020 report was not available. For the 2019 profile study, NACCHO used a database of local health departments (LHDs) based on previous profile studies and consulted with State health agencies and the State Associations of Local Health Officials (SACCHOs) to identify additional LHDs for inclusion in the study population. For the 2019 study, a total of 2,459 LHDs were included in the study population. Rhode Island was excluded from the study because the State health agency operates on behalf of local public health and has no sub-state units. For the first time, Hawaii was included.

Exhibit 3-59: Estimated Average Number of Local Health Agencies and Targeted Medical Providers per CWS

System Size	# of Systems	Population Served	Number of Agencies Proportionally Distributed	Number of Agencies per System	Number of Agencies per System (Rounded Up to Nearest Whole Number)
	A	**B**	**C**	**D = C/A**	**E**
≤ 100	11,732	708,236	364	0.0	1.0
101–500	15,084	3,830,126	1,971	0.1	1.0
501–1000	5,330	3,931,488	2,023	0.4	1.0
1001–3300	7,967	15,218,647	7,830	1.0	1.0
3301–10000	5,026	29,565,710	15,211	3.0	3.0
10001–50000	3,374	74,162,674	38,156	11.3	12.0
50001–100000	571	39,629,417	20,389	35.7	36.0
100001–1M	421	99,359,362	51,120	121.4	122.0
>1M	24	46,638,891	23,995	999.8	1,000.0
Total	**49,529**	**313,044,551**	**161,059**		

Sources:
A: Exhibit 3-2.
B: Exhibit 3-4.
C: Calculated from SDWIS/Fed data 4th quarter 2020 frozen data set, 2010 NACCHO data (NACCHO, 2019) for the number of local health department, and the U.S. Bureau of Labor Statistics "Occupational Outlook Handbook" (U.S. Bureau of Labor Statistics, 2021) for the number of ob-gyns, pediatricians, and family medicine physicians (see Steps 1 through 4 above).

3.3.10.1.4 Discussion of Data Limitations and Uncertainty

The number of entities that will receive PE under the pre-2021 LCR, 2021 LCRR, and final LCRI in response to a lead ALE may be an underestimation because the number of entities may continue to increase each year to meet the needs of growing populations. In addition, the estimated number of facilities focused on schools, child care facilities, pediatricians, ob/gyns, and family medical providers does not include other groups that are required to receive PE, *i.e.*, Women, Infants, and Children (WIC); Head Start; public and private hospitals and clinics; family planning centers; and local welfare agencies. From a national perspective, the EPA does not anticipate these limitations to have an impact on the incremental costs to deliver PE in response to a lead ALE under the final LCRI because the requirements pertaining to delivery to these groups remain unchanged from the pre-2021 LCR and 2021 LCRR.

The uncertainty in the estimated number of schools that exist when the final LCRI goes into effect may result in an underestimate of costs for CWSs to conduct lead sampling at these facilities. In addition, the number of child care facilities may be overestimated because the source, CED (2019), may include non-licensed facilities, which are not subject to LCRI requirements and would result in an overestimate of costs. The resulting impact of all these factors may be an under or overestimate of national costs. The

EPA does not expect this uncertainty to have a significant impact on national cost and benefit estimates in this EA.

3.3.10.2 Estimated Percentage of Schools and Child Care Facilities that Are Waived from Monitoring Requirements

As noted previously, the 2021 LCRR and final LCRI allow States to waive school and/or licensed child care facility sampling requirements for individual CWSs under certain circumstances when States have existing programs or when sampling has been completed using WIIN grant funds. For detailed information on eligibility under the 2021 LCRR and final LCRI, see Section 3.3.10. The EPA expanded the time period for waivers under the final LCRI to allow the State to waive a CWS from testing a facility that was sampled from January 1, 2021 through the compliance date of the LCRI (assumed to be October 2027). The 2021 LCRR does not allow States to waive requirements based on sampling conducted prior to the LCRR compliance date of October 16, 2024.

The EPA used two methods to identify instances where schools and child care facilities served by CWSs would be waived from monitoring requirements under the 2021 LCRR and final LCRI:

1. Review State regulations for required programs, and
2. Review funds allocated to States for lead testing through the Water Infrastructure Improvement for the Nation (WIIN) grant.

Systems that would meet the minimum requirements of the 2021 LCRR and final LCRI would be considered waived from the school sampling requirements and would not incur any burden or cost for these activities. This section provides the evaluation of State regulations first, followed by the analysis of school and child care facility sampling performed using WIIN grant funding.

3.3.10.2.1 Analysis of State Regulations

Some States have developed their own requirements for lead testing of drinking water at schools and child care facilities. The purpose of this section is to describe the EPA's approach for identifying States with programs that are at least as stringent as the 2021 LCRR and final LCRI for public and/or private elementary, public and/or private secondary schools, and licensed child care facilities. The EPA assumed CWSs in these States would not incur burden or costs to meet these requirements under the final LCRI because States will elect to waive these requirements.

During 2022 and 2023, the EPA collected data and conducted internet searches to identify States with regulations that are at least as stringent as those required under the 2021 LCRR and final LCRI for public elementary schools, private elementary schools, public secondary schools, private secondary schools, and/or child care facilities. Exhibit 3-60 and Exhibit 3-61 summarize the results of this review for the first five-year cycle under 2021 the LCRR and final LCRI, respectively. Note that because of the expanded waiver eligibility to include sampling conducted prior to the rule compliance date under the final LCRI compared to the 2021 LCRR, additional State programs qualify for waivers for elementary schools, secondary schools, and licensed child care facilities.

Exhibit 3-60: States with Existing Programs that Satisfy the Waiver Requirements under the 2021 LCRR for the First Five-Year Cycle[1]

States with Equivalent Program	For Public Elementary Schools	For Private Elementary Schools	For Public Secondary Schools	For Private Secondary Schools	For Child Care Facilities
District of Columbia	X		X		X
Indiana	X		X		
Maryland	X	X	X	X	
Minnesota	X		X		
Missouri	X	X	X	X	
Montana	X	X	X	X	
New Hampshire					X
New Jersey	X		X		X
New York	X		X		
North Carolina	X		X		X
Oregon	X		X		X
Pennsylvania	X		X		
Utah	X	X	X	X	
Vermont	X	X	X	X	X
Washington	X		X		X
Total Number of States	**14**	**5**	**14**	**5**	**7**

Note:
[1] CWSs are assumed to incur no burden for the lead in drinking water testing at facilities in States marked with an "X" for the first five-year cycle. The table only includes those States that include all of a particular subset (*e.g.*, all public elementary schools). States that have requirements for a smaller subset of schools, such as school constructed before 1998, are not included in this table.

Exhibit 3-61: States with Existing Programs that Satisfy the Waiver Requirements under the Final LCRI for the First Five-Year Cycle[1]

States with Equivalent Program	For Public Elementary Schools	For Private Elementary Schools	For Public Secondary Schools	For Private Secondary Schools	For Child Care Facilities
California					X[2]
Colorado	X				X
District of Columbia	X		X		X
Indiana	X		X		
Maine	X	X	X	X	
Maryland	X	X	X	X	
Minnesota	X		X		
Missouri	X	X	X	X	
Montana	X	X	X	X	
New Hampshire					X
New Jersey	X		X		X
New York	X		X		
North Carolina	X		X		X

States with Equivalent Program	For Public Elementary Schools	For Private Elementary Schools	For Public Secondary Schools	For Private Secondary Schools	For Child Care Facilities
Oregon	X		X		X
Pennsylvania	X		X		
Utah	X	X	X	X	X
Vermont	X	X	X	X	X
Washington	X		X		X
Total Number of States	**16**	**6**	**15**	**6**	**10**

Note:

[1] CWSs are assumed to incur no burden for the lead in drinking water testing at facilities in States marked with an "X" for the first five-year cycle. The table only includes those States that include all of a particular subset (*e.g.*, all public elementary schools). States that have requirements for a smaller subset of schools, such as school constructed before 1998, are not included in this table.

[2] In California's Assembly Bill 2370 required testing of all licensed child care facilities on private property constructed before Jan 1, 2010 (which is the effective date of California lead ban), requires one-time testing between January 1, 2020 and January 1, 2023. Only data from 2021 - 2023 can be used to satisfy the requirements for the final LCRI. Thus, the EPA assumed that 75 percent of child care facilities would qualify for a waiver under the final LCRI.

Exhibit 3-62 and Exhibit 3-63 summarizes the results for the subsequent five-year cycles under the 2021 LCRR and final LCRI, respectively. Note that one additional State program for licensed child care facility testing (Utah) would be qualified to issue waivers under the final LCRI compared to the 2021 LCRR.

Exhibit 3-62: States with Existing Programs that Satisfy the Waiver Requirements Under the 2021 LCRR for the Second Five-Year Cycle and Subsequent Five-Year Cycles[1]

States with Equivalent Program	For Public Elementary Schools	For Private Elementary Schools	For Public Secondary Schools	For Private Secondary Schools	For Child Care Facilities
District of Columbia	X		X		X
Maryland	X	X	X	X	
Minnesota	X		X		
Missouri	X	X	X	X	
Montana	X	X	X	X	
New Hampshire					X
New Jersey	X		X		X
New York	X		X		
North Carolina					X
Oregon	X		X		X
Pennsylvania	X		X		
Vermont	X	X	X	X	X
Washington	X		X		X
Total Number of States	**11**	**4**	**11**	**4**	**7**

Note:

[1] CWSs are assumed to incur no burden for the lead in drinking water testing at facilities in States marked with an "X" for the second and subsequent five-year cycles.

Exhibit 3-63: States with Existing Programs that Satisfy the Waiver Requirements Under the Final LCRI for the Second Five-Year Cycle and Subsequent Five-Year Cycles[1]

States with Equivalent Program	For Public Elementary Schools	For Private Elementary Schools	For Public Secondary Schools	For Private Secondary Schools	For Child Care Facilities
District of Columbia	X		X		X
Maryland	X	X	X	X	
Minnesota	X		X		
Missouri	X	X	X	X	
Montana	X	X	X	X	
New Hampshire					X
New Jersey	X		X		X
New York	X		X		
North Carolina					X
Oregon	X		X		X
Pennsylvania	X		X		
Utah					X
Vermont	X	X	X	X	X
Washington	X		X		X
Total Number of States	**11**	**4**	**11**	**4**	**8**

Note:
[1] CWSs are assumed to incur no burden for the lead in drinking water testing at facilities in States marked with an "X" for the second and subsequent five-year cycles.

3.3.10.2.2 Analysis of WIIN grand funding

Section 2107 of the WIIN Act of 2016 established the Lead Testing in School and Child Care Program Drinking Water grant to award funding to States and Tribes to test for lead in public elementary schools and child care facilities. Testing must be in accordance with the EPA's 3T guidance (USEPA, 2018) or applicable State regulations, and results must be made publicly available. The 3T's recommends that schools sample for lead at every tap, which would meet the minimum requirements of the 2021 LCRR sampling that is maintained in the final LCRI (which is required at a minimum of five taps in schools).

To estimate the percent of public elementary schools[80] and child care facilities that could be tested using WIIN grant funds in each State, the EPA used the following three-step approach. Note that each step is discussed in detail following the bullets.

- Step 1: Estimate the average burden and costs for conducting lead tap sampling at a single school or child care facility.
- Step 2: Estimate WIIN grant funds allocated to each State from January 1, 2021 through federal fiscal year (FY) 2026.

[80] The WIIN grant funding cannot be used for private schools. WIIN grant funding can be used for public elementary and secondary schools and public and private child care facilities. The EPA recommends States prioritize elementary schools and child care facilities that serve children ages 6 and younger. For purposes of this analysis, the EPA assumed the funding would be used to only test elementary schools and child care facilities.

- Step 3: Use the results from Steps 1 and 2 to estimate the proportion of public elementary schools and child care facilities that can be tested between October 16, 2024 through FY 2026 under for 2021 LCRR and between January 1, 2021 and FY 2026 under the final LCRI using WIIN grant funds. These schools and child care facilities would be waived from testing requirements during the first five-year cycle under the 2021 LCRR and final LCRI, respectively.

The results from this analysis for elementary schools and child care facilities are combined with the waivers based on State testing requirements to estimate the total percent of schools eligible for a waiver under the 2021 LCRR and final LCRI for first five-year cycle.

Step 1: Estimate the average burden and costs for conducting lead tap sampling at a single school or child care facility.

The EPA estimated non-labor and labor costs associated with a lead in drinking water sampling event for an elementary school and a child care facility. Due to the wide range in school size and plumbing configurations, the EPA prepared a low and high unit cost estimate. The major components of the cost estimate are described below. For additional details and assumptions, see the derivation file "School_Child Care Inputs_Final.xlsx", worksheet "Unit_Burden Costs."

As a starting point, the EPA estimated the number of taps that are sampled per elementary school and child care facility. Because 3Ts recommends sampling at all taps used for cooking and drinking, the EPA assumed that any elementary school or child care facility utilizing WIIN grant funds would sample at all their taps. To represent the possible range of school configurations, the EPA used two data sources: the minimum number of required plumbing fixtures from Table 403.1 of the 2021 International Plumbing Code (IPC) as a low estimate, and sampling results from five States as a high estimate. To estimate the number of taps sampled per child care facility, the EPA used the required number of taps from the 2021 LCRR (and maintained in the final LCRI) as a low estimate and data from two States (New York and Nebraska) as the high estimate. The results are shown in Exhibit 3-64.

Exhibit 3-64: Low and High Estimate for the Number of Taps to be Sampled for Elementary Schools and Child Care Facilities

Schools		Child Care Facilities	
Average Number (Low)	**Average Number (High)**	**Minimum Required (Low)**	**Average Number (High)**
A	B	C	D
9	36	2	3

Source: Derivation file "School_Child Care Inputs_Final.xlsx", worksheet "Unit_Burden Costs."
Notes:
A: Based on weighted average number of taps for elementary schools based on minimum number of required plumbing fixture from Table 403.1 of the 2021 IPC. See file "Analysis of School_Child Care Sample Number_Final.xlsx", worksheet "School Sample # Based on IPC."
B: Based on the average of five States with sampling data in Table B-2 from the file, "Analysis of School_Child Care Sample Number_Final.xlsx", worksheet "School Summary Statistics." Note that this average does not include sample values that were less than the 5th percentile or greater than the 95th percentile.
C: Equals the minimum number of samples specified in the 2021 LCRR, which has not been revised under the final LCRI).

D: Based on average number of taps sampled by child care facilities in New York and Nebraska. See file " Analysis of School_Child Care Sample Number_Final.xlsx ", worksheet "Child Care Summary Statistics."

To calculate non-labor costs, the EPA used an estimated commercial laboratory cost per lead sample analyzed of $23.50, in 2020 dollars. This value is based on quotes from seven laboratories (see the Derivation file “Lead Analytical Burden and Cost_Final.xlsx”, worksheet “Commercial Analytical_$” for details). The EPA also added shipping costs based on sample weight estimates and United States Postal Service (USPS) shipping rates.

To estimate labor costs associated with lead in drinking water sampling at elementary schools and child care facilities, the EPA first estimated the burden associated with sampling activities. See Exhibit 3-65 and Exhibit 3-66 for estimates of burden per sampling event for elementary schools and child care facilities, respectively.

Exhibit 3-65: Estimated Burden per Elementary School Sampling Event

Activity	Hours/Sampling Event		
	Low End	High End	Average
A: Develop a Sampling Plan	8.0	8.0	8.0
B: Collect Samples	1.5	6.0	3.8
C: Have Samples Analyzed	0.0	0.0	0.0
D: Provide Results to State/Parents	2.0	2.0	2.0
Total hours per sampling event	11.50	16.0	13.8

Source: Derivation file “School_Child Care Inputs_Final.xlsx,” worksheet “Unit_Burden Costs.”
Notes:
General: The school will follow the procedures outlined in the 3Ts guidance.
A: The EPA assumes schools will require 8 hours to read information provided by the State on the sampling program and to develop a sampling plan.
B: The EPA assumed schools will require 10 minutes per sample because they will have prepared a sampling plan and will be familiar with the location of taps to be samples. The per sample burden is multiplied by the number of samples in Column A in Exhibit 3-64 for the low end and Column B in Exhibit 3-64 for the high end.
C: All samples are assumed to be analyzed by a commercial lab.
D: The EPA assumes schools will require 2 hours to prepare the notice, email, and post the results.

Exhibit 3-66: Estimated Burden per Child Care Facility Sampling Event

Activity	Hours/Sampling Event		
	Low End	High End	Average
A: Develop a Sampling Plan	4.0	4.0	4.00
B: Collect Samples	0.3	0.5	0.42
C: Have Samples Analyzed	0.0	0.0	0.00
D: Provide Results to State/Parents	2.0	2.0	2.00
Total hours per sampling event	6.3	6.5	6.42

Source: Derivation file “School_Child Care Inputs_Final.xlsx,” worksheet “Unit_Burden Costs.”
Notes:

General: The child care facility will follow the procedures outlined in the 3Ts guidance.
A: The EPA assumes child care facilities will require 4 hours to read information provided by the State on the sampling program and to develop a sampling plan. The EPA assumed fewer hours are required for child care facilities than schools to develop the sampling plan because the child care facility is more likely to be smaller than a school and will have fewer taps to sample.
B: The EPA assumed child care facilities will require 10 minutes per sample because they will have prepared a sampling plan and will be familiar with the location of taps to be samples. The per sample burden is multiplied by the number of samples in Column A in Exhibit 3-64 for the low end and Column B in Exhibit 3-64 for the high end.
C: All samples are assumed to be analyzed by a commercial lab.
D: The EPA assumes child care facilities will require 2 hours to prepare the notice, email, and post the results.

To convert labor burden to cost, the EPA estimated labor rates for school maintenance workers and for child care facility workers using national averages from the U. S. Bureau of Labor Statistics. The per hour labor rates used for this analysis, in 2020 dollars, are $21.05 for a school maintenance worker and $12.88 for a child care facility worker. For additional details and citations, see the derivation file "School_Child Care Inputs_Final.xlsx," worksheet "Labor Rates."

The EPA combined non-labor costs for sample analysis and shipping with the labor costs associated with the activities in Exhibit 3-65 and Exhibit 3-66 to develop a low, high, and average cost estimate per sampling event per elementary school and child care facility. Results are shown in Exhibit 3-67 and Exhibit 3-68, respectively. In summary, the EPA estimated that the total cost of a sample event for an elementary school costs on average **$840.41**, and the total cost of a sample event for a child care facility costs on average **$149.27**.

Exhibit 3-67: Estimated Total Cost per Elementary School Sample Event (2020$)

Activity	Cost/Sampling Event		
	Low End	**High End**	**Average**
A: Develop a Sampling Plan	$168.40	$168.40	$168.40
B: Collect Samples	$31.58	$126.30	$78.94
C: Have Samples Analyzed	$223.45	$878.50	$550.98
D: Provide Results to State/Parents	$42.10	$42.10	$42.10
Total non-labor & labor cost per sampling event	**$465.53**	**$1,215.30**	**$840.41**

Source: Derivation file "School_Child Care Inputs_Final.xlsx," worksheet "Unit_Burden Costs."
Notes:
A, B, D: Labor costs estimated by multiplying the burden in Exhibit 3-66 by the hourly labor rate for school maintenance worker of $21.05, in 2020$.
C: Non labor costs estimated by multiplying the number of samples in Exhibit 3-75 by the per sample commercial laboratory cost of $23.50 plus shipping costs, in 2020$. For detailed assumptions for shipping costs, see the derivation file "School_Child Care Inputs_Final.xlsx," worksheet "Unit_Burden Costs."

Exhibit 3-68: Estimated Total Cost per Child Care Facility Sample Event (2020$)

Activity	Cost/Sampling Event		
	Low End	**High End**	**Average**
A: Develop a Sampling Plan	$51.52	$51.52	$51.52
B: Collect Samples	$4.29	$6.44	$5.37
C: Have Samples Analyzed	$55.25	$78.00	$66.63
D: Provide Results to State/Parents	$25.76	$25.76	$25.76
Total non-labor & labor cost per sampling event	**$136.82**	**$161.72**	**$149.27**

Source: Derivation file "School_Child Care Inputs_Final.xlsx", worksheet "Unit_Burden Costs."

Notes:

A, B, D: Labor costs estimated by multiplying the burden in Exhibit 3-66 by the hourly labor rate for child care facility worker of $12.88, in 2020$.

C: Non labor costs estimated by multiplying the number of samples in Exhibit 3-75 by the per sample commercial laboratory cost of $23.50 plus shipping costs, in 2020$. For detailed assumptions for shipping costs, see the derivation file "School_Child Care Inputs_Final.xlsx", worksheet "Unit_Burden Costs."

Step 2: Estimate the WIIN grant funds per State from 2021 through 2026.

This analysis started with final allotments to each State for federal FY 2021 through 2023.[81] Estimated WIIN grant funding for FY 2024 is based on an authorized total appropriation of $40 million, with total appropriations increasing by $5 million each year thereafter through FY 2026.[82] The EPA reduced the allotments by four percent to account for maximum allowable State costs to administer the grant program (USEPA, 2020b). The EPA assumed that the percent of funds allotted to each State would be the same in FY 2024 through 2026 as it was in FY 2023. Exhibit 3-69 provides the results of the analysis.

[81] Updated allotments for FY 2021 are available online here https://www.epa.gov/system/files/documents/2022-02/fy2021_lead_testing_allotments_wiin_2107.pdf, released June 2021. 2022 and 2023 allotments are available online at https://www.epa.gov/system/files/documents/2023-07/School%20Lead%20Testing%20and%20Reduction%20AllotmentMemo-July%202023_Final_0.pdf , issued July 21, 2023. Note that the Federal Fiscal Year is from October 1 through September 30. For example, Fiscal Year 2021 (FY 2021) started on October 1, 2020, and ended on September 30, 2021.

[82] Infrastructure Investment and Jobs Act, Section 50110, Lead Contamination in School Drinking water. Amendment to Section 1464 of the SDWA (42 U.S.C. 300j–24). Authorization of appropriations. Available online at https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf.

Exhibit 3-69: 2021-2023 WIIN Grant Allotment and Projected WIIN Grant Funding for FY 2024 – FY 2026

State	FY 2021 Allotment	FY 2022 Allotment	FY 2023 Allotment	Percent Allotment per State for FY 2023	Projected FY 2024	Projected FY 2025	Projected FY 2026
	A	B	C	D	E=38.4M*D	F=43.2M*D	G=48M*D
Totals	**$23,534,400**	**$24,422,400**	**$27,086,400**	**100%**	**$38,400,000**	**$43,200,000**	**$48,000,000**
Alabama	$312,960	$330,240	$366,720	1.4%	$519,894	$584,880	$649,867
Alaska	$65,280	$67,200	$74,880	0.3%	$106,156	$119,426	$132,695
Arizona	$380,160	$392,640	$434,880	1.6%	$616,523	$693,589	$770,654
Arkansas	$238,080	$245,760	$272,640	1.0%	$386,518	$434,833	$483,147
California	$2,210,880	$2,445,120	$2,712,000	10.0%	$3,844,763	$4,325,359	$4,805,954
Colorado	$366,720	$380,160	$421,440	1.6%	$597,469	$672,153	$746,837
Connecticut	$345,600	$386,880	$429,120	1.6%	$608,357	$684,402	$760,447
Delaware	$86,400	$89,280	$98,880	0.4%	$140,181	$157,703	$175,226
District of Columbia	$82,560	$84,480	$93,120	0.3%	$132,015	$148,517	$165,019
Florida	$1,005,120	$1,033,920	$1,146,240	4.2%	$1,625,008	$1,828,134	$2,031,260
Georgia	$823,680	$1,087,680	$1,206,720	4.5%	$1,710,750	$1,924,593	$2,138,437
Hawaii	$85,440	$83,520	$93,120	0.3%	$132,015	$148,517	$165,019
Idaho	$221,760	$151,680	$168,000	0.6%	$238,171	$267,943	$297,714
Illinois	$989,760	$1,032,000	$1,144,320	4.2%	$1,622,286	$1,825,072	$2,027,858
Indiana	$406,080	$557,760	$618,240	2.3%	$876,470	$986,029	$1,095,587
Iowa	$283,200	$289,920	$321,600	1.2%	$455,928	$512,919	$569,910
Kansas	$278,400	$290,880	$322,560	1.2%	$457,289	$514,450	$571,611
Kentucky	$334,080	$318,720	$353,280	1.3%	$500,840	$563,445	$626,050
Louisiana	$559,680	$368,640	$408,960	1.5%	$579,777	$652,249	$724,721
Maine	$323,520	$169,920	$189,120	0.7%	$268,113	$301,627	$335,141
Maryland	$318,720	$324,480	$360,000	1.3%	$510,367	$574,163	$637,959
Massachusetts	$313,920	$841,920	$934,080	3.4%	$1,324,232	$1,489,761	$1,655,290
Michigan	$666,240	$878,400	$974,400	3.6%	$1,381,393	$1,554,067	$1,726,741

State	FY 2021 Allotment	FY 2022 Allotment	FY 2023 Allotment	Percent Allotment per State for FY 2023	Projected FY 2024	Projected FY 2025	Projected FY 2026
	A	B	C	D	E=38.4M*D	F=43.2M*D	G=48M*D
Minnesota	$412,800	$420,480	$466,560	1.7%	$661,435	$744,115	$826,794
Mississippi	$288,960	$302,400	$335,040	1.2%	$474,981	$534,354	$593,727
Missouri	$493,440	$446,400	$495,360	1.8%	$702,265	$790,048	$877,831
Montana	$259,200	$257,280	$285,120	1.1%	$404,211	$454,737	$505,263
Nebraska	$342,720	$351,360	$389,760	1.4%	$552,557	$621,627	$690,696
Nevada	$154,560	$251,520	$278,400	1.0%	$394,684	$444,019	$493,355
New Hampshire	$851,520	$220,800	$245,760	0.9%	$348,410	$391,962	$435,513
New Jersey	$465,600	$480,960	$533,760	2.0%	$756,704	$851,292	$945,880
New Mexico	$167,040	$174,720	$192,960	0.7%	$273,557	$307,751	$341,946
New York	$1,131,840	$1,128,000	$1,250,880	4.6%	$1,773,355	$1,995,024	$2,216,693
North Carolina	$544,320	$584,640	$648,000	2.4%	$918,660	$1,033,493	$1,148,325
North Dakota	$82,560	$73,920	$81,600	0.3%	$115,683	$130,144	$144,604
Ohio	$720,960	$669,120	$742,080	2.7%	$1,052,036	$1,183,541	$1,315,045
Oklahoma	$352,320	$674,880	$747,840	2.8%	$1,060,202	$1,192,727	$1,325,253
Oregon	$624,960	$524,160	$580,800	2.1%	$823,392	$926,316	$1,029,240
Pennsylvania	$943,680	$904,320	$1,003,200	3.7%	$1,422,222	$1,600,000	$1,777,778
Rhode Island	$382,080	$280,320	$310,080	1.1%	$439,596	$494,545	$549,495
South Carolina	$296,640	$299,520	$333,120	1.2%	$472,259	$531,292	$590,324
South Dakota	$157,440	$193,920	$215,040	0.8%	$304,859	$342,967	$381,074
Tennessee	$325,440	$370,560	$411,840	1.5%	$583,860	$656,842	$729,825
Texas	$1,924,800	$1,960,320	$2,174,400	8.0%	$3,082,616	$3,467,943	$3,853,270
Utah	$267,840	$272,640	$302,400	1.1%	$428,708	$482,297	$535,885
Vermont	$112,320	$116,160	$129,600	0.5%	$183,732	$206,699	$229,665
Virginia	$412,800	$423,360	$469,440	1.7%	$665,518	$748,708	$831,898
Washington	$459,840	$589,440	$653,760	2.4%	$926,826	$1,042,679	$1,158,533
West Virginia	$147,840	$148,800	$165,120	0.6%	$234,088	$263,349	$292,610

State	FY 2021 Allotment	FY 2022 Allotment	FY 2023 Allotment	Percent Allotment per State for FY 2023	Projected FY 2024	Projected FY 2025	Projected FY 2026
	A	**B**	**C**	**D**	**E=38.4M*D**	**F=43.2M*D**	**G=48M*D**
Wisconsin	$449,280	$385,920	$428,160	1.6%	$606,996	$682,871	$758,745
Wyoming	$63,360	$65,280	$72,000	0.3%	$102,073	$114,833	$127,592

Source: "School_Child Care Inputs_Final.xlsx," worksheet, "Project WIIN Funding Available."

Notes:

A: The EPA allotment memo for FY 2021 (USEPA, 2020b), issued June 2021. Does not include American Samoa, Puerto Rico, and the Virgin Islands. Reduced by 4% to account for maximum allowable percent of grant funds that can be used by States to pay for the administrative costs of carrying out the program, per USEPA (2020c).

B and C: The EPA allotment memo for FY 2022 and 2023 (USEPA, 2023c), issued July 21, 2023. Does not include American Samoa, Puerto Rico, and the Virgin Islands. Reduced by 4% to account for maximum allowable percent of grant funds that can be used by States to pay for the administrative costs of carrying out the program, per USEPA (2020c).

D: Percent of WIIN grant funds allotted to each State in FY 2023.

F-J: Total allotment from the Infrastructure Investment and Jobs Act, Section 50110, Lead Contamination in School Drinking water. Amendment to Section 1464 of the Safe Drinking Water Act (42 U.S.C. 300j–24). Authorization of appropriations. Available online at https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf. Assume that the proportion of total funds allocated to each State is consistent with FY 23 allocations. Reduced by 4 percent to account for the maximum allowable percent of grant funds that can be used by States to pay for the administrative costs of carrying out the program, per USEPA (2020c). Thus for each State, their funding is equal to the total funding for that fiscal year multiplied by the percent in Column D.

Step 3: Use the results from Steps 1 and 2 to estimate the proportion of elementary schools and child care facilities that can be tested using WIIN grant funds under the 2021 LCRR and final LCRI. Under the 2021 LCRR, the EPA considered funds available beginning October 2024 through FY 2026. For the final LCRI, the EPA considered the funds available starting January 2021 through FY 2026 to reflect the change in waiver eligibility. These calculations are in the form of large tables that can be found in the Derivation file, "School_Child Care Inputs_Final.xlsx", worksheets "Proj_Tested_WIIN Grant_LCRR" and "Proj_Tested_WIIN Grant_LCRI." This step involves two main sub-steps:

- The average of the high and low unit costs per sampling event from Step 1 was used to estimate what it would cost to sample all public elementary schools and child care facilities in each State. See Sections 3.3.10.1.1 and 3.3.10.1.2 for the estimated number of elementary schools and child care facilities, respectively, in each State. The States with existing programs that satisfy the waiver requirements for the first five-year cycle for public elementary schools and child care facilities, as shown in Exhibit 3-70 for the 2021 LCRR and in Exhibit 3-71 for the final LCRI, were also excluded from the analysis.

- The total costs for sampling public elementary schools and child care facilities was compared to the WIIN grant allotments starting on October 16, 2024 for the 2021 LCRR and January 1, 2021 for the LCRI. The EPA assumed that States would take full advantage of the available funding to sample elementary schools and child care facilities. Therefore, the EPA subtracted available WIIN grant funds from the total cost for sampling all public elementary schools and child care facilities to estimate the remaining funds needed to sample all public elementary schools and child care facilities. The EPA did this for each year starting in FY 2025 and FY 2026 under the 2021 LCRR, and January 2021 through FY 2026 under the LCRI. Based on these data, nearly all States should be able to use the WIIN grant funds to sample 100 percent of their public elementary schools and child care facilities during the first five-year cycle under the final LCRI. See Exhibit 3-70 and Exhibit 3-71 for results per State for the 2021 LCRR and final LCRI, respectively.

  Note that the EPA assumed CWSs in States in which the rows have gray shading would be waived from conducting lead in school and/or child care facilities testing, due to State regulations. Therefore, the EPA did not consider the schools and child care facilities in those States as part of this step.

Exhibit 3-70: Estimated Percent of Public Elementary Schools and Child Care Facilities that Could be Sampled to Comply with the 2021 LCRR Using WIIN Grant Funds from October 16, 2024 – FY 2026

State	Percent of Child Care Facilities Sampled Using WIIN Grant Funds from October 16, 2024 – FY 2026	Percent of Public Elementary Schools Sampled Using WIIN Grant Funds from October 16, 2024 – FY 2026
Alabama	61.2%	61.2%
Alaska	46.7%	46.7%
Arizona	48.8%	48.8%
Arkansas	67.0%	67.0%
California	44.2%	44.2%

State	Percent of Child Care Facilities Sampled Using WIIN Grant Funds from October 16, 2024 – FY 2026	Percent of Public Elementary Schools Sampled Using WIIN Grant Funds from October 16, 2024 – FY 2026
Colorado	54.4%	54.4%
Connecticut	81.6%	81.6%
Delaware	92.3%	92.3%
District of Columbia		
Florida	47.8%	47.8%
Georgia	81.9%	81.9%
Hawaii	82.2%	82.2%
Idaho	66.2%	66.2%
Illinois	43.6%	43.6%
Indiana	100.0%	
Iowa	42.7%	42.7%
Kansas	55.2%	55.2%
Kentucky	64.6%	64.6%
Louisiana	57.7%	57.7%
Maine	95.0%	95.0%
Maryland	57.2%	
Massachusetts	100.0%	100.0%
Michigan	63.2%	63.2%
Minnesota	66.7%	
Mississippi	59.5%	59.5%
Missouri	85.9%	
Montana	100.0%	
Nebraska	81.6%	81.6%
Nevada	72.2%	72.2%
New Hampshire		100.0%
New Jersey		
New Mexico	69.9%	69.9%
New York	44.1%	
North Carolina		
North Dakota	37.7%	37.7%
Ohio	46.6%	46.6%
Oklahoma	100.0%	100.0%
Oregon		
Pennsylvania	100.0%	
Rhode Island	100.0%	100.0%
South Carolina	55.8%	55.8%
South Dakota	87.7%	87.7%
Tennessee	43.1%	43.1%
Texas	51.6%	51.6%
Utah	100.0%	

State	Percent of Child Care Facilities Sampled Using WIIN Grant Funds from October 16, 2024 – FY 2026	Percent of Public Elementary Schools Sampled Using WIIN Grant Funds from October 16, 2024 – FY 2026
Vermont		
Virginia	43.1%	43.1%
Washington		
West Virginia	67.8%	67.8%
Wisconsin	50.2%	50.2%
Wyoming	57.6%	57.6%

Source: "School_Child Care Inputs_Final.xlsx," worksheet, "Proj_Tested_WIIN Grant_LCRR."
Note: The EPA assumed CWSs in States in which the rows have gray shading would be waived from conducting lead in school and/or child care facility testing due to State regulations.

Exhibit 3-71: Estimated Percent of Public Elementary Schools and Child Care Facilities that Could be Sampled to Comply with the Final LCRI Using WIIN Grant Funds from January 1, 2021 – FY 2026

State	Percent of Child Care Facilities Sampled Using WIIN Grant Funds from January 1, 2021 – FY 2026	Percent of Public Elementary Schools Sampled Using WIIN Grant Funds from January 1, 2021 – FY 2026
Alabama	100.0%	100.0%
Alaska	100.0%	100.0%
Arizona	100.0%	100.0%
Arkansas	100.0%	100.0%
California		95.8%
Colorado		
Connecticut	100.0%	100.0%
Delaware	100.0%	100.0%
District of Columbia		
Florida	100.0%	100.0%
Georgia	100.0%	100.0%
Hawaii	100.0%	100.0%
Idaho	100.0%	100.0%
Illinois	94.9%	94.9%
Indiana	100.0%	
Iowa	93.1%	93.1%
Kansas	100.0%	100.0%
Kentucky	100.0%	100.0%
Louisiana	100.0%	100.0%
Maine	100.0%	
Maryland	100.0%	
Massachusetts	100.0%	100.0%
Michigan	100.0%	100.0%
Minnesota	100.0%	
Mississippi	100.0%	98.3%

State	Percent of Child Care Facilities Sampled Using WIIN Grant Funds from January 1, 2021 – FY 2026	Percent of Public Elementary Schools Sampled Using WIIN Grant Funds from January 1, 2021 – FY 2026
Missouri	100.0%	
Montana	100.0%	
Nebraska	100.0%	100.0%
Nevada	100.0%	100.0%
New Hampshire		100.0%
New Jersey		
New Mexico	100.0%	100.0%
New York	96.4%	
North Carolina		
North Dakota	83.4%	83.4%
Ohio	100.0%	100.0%
Oklahoma	100.0%	100.0%
Oregon		
Pennsylvania	100.0%	
Rhode Island	100.0%	100.0%
South Carolina	100.0%	100.0%
South Dakota	100.0%	100.0%
Tennessee	93.1%	93.1%
Texas	100.0%	100.0%
Utah		
Vermont		
Virginia	94.1%	94.1%
Washington		
West Virginia	100.0%	100.0%
Wisconsin	100.0%	100.0%
Wyoming	100.0%	100.0%

Source: "School_Child Care Inputs_Final.xlsx," worksheet, "Proj_Tested_WIIN Grant_LCRI."
Note: The EPA assumed CWSs in States in which the rows have gray shading would be waived from conducting lead in school and/or child care facility testing due to State regulations.

The EPA combined the results of the State regulatory analysis and the WIIN grant fund analysis to predict the percent of each child care facility and type of school (public and private, elementary and secondary) that would meet the criteria for a waiver under the 2021 LCRR and the final LCRI for the first five-year and second five-year cycles. The final results of the analysis are provided in Exhibit 3-72 for the 2021 LCRR and Exhibit 3-73 for the final LCRI. Note that results for child care facilities and public elementary schools for the first five-year cycle reflect the analysis of available WIIN grant funds in addition to State regulations. The results for child care facilities and public elementary schools for the second five-year cycle, and all results for private elementary, public secondary, and public secondary schools reflect the analysis of State regulations only. The text in red font are variable names of the costing inputs for the SafeWater LCR model.

Exhibit 3-72: Percent of Schools and Child Care Facilities Eligible for Waivers under the 2021 LCRR based on State Regulations and WIIN Grant Funding

State	Percent of Child Care Facilities Eligible for Waiver for:		Percent of Public Elementary Schools Eligible for Waiver for:		Percent of Private Elementary Schools Eligible for Waiver for:		Percent of Public Secondary Schools Eligible for Waiver for:		Percent of Private Secondary Schools Eligible for Waiver for:	
	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on
	pp_childcare_mand_waiver	*pp_childcare_onreq_waiver*	*pp_pub_elem_mand_waiver*	*pp_pub_elem_onreq_waiver*	*pp_priv_elem_mand_waiver*	*pp_priv_elem_onreq_waiver*	*pp_pub_second_onreq1_waiver*	*pp_pub_second_onreq2on_waiver*	*pp_priv_second_onreq1_waiver*	*pp_priv_second_onreq2on_waiver*
Alabama	61.2%	0%	61.2%	0%	0%	0%	0%	0%	0%	0%
Alaska	46.7%	0%	46.7%	0%	0%	0%	0%	0%	0%	0%
Arizona	48.8%	0%	48.8%	0%	0%	0%	0%	0%	0%	0%
Arkansas	67.0%	0%	67.0%	0%	0%	0%	0%	0%	0%	0%
California	44.2%	0%	44.2%	0%	0%	0%	0%	0%	0%	0%
Colorado	54.4%	0%	54.4%	0%	0%	0%	0%	0%	0%	0%
Connecticut	81.6%	0%	81.6%	0%	0%	0%	0%	0%	0%	0%
Delaware	92.3%	0%	92.3%	0%	0%	0%	0%	0%	0%	0%
District of Columbia	100.0%	100%	100.0%	100%	0%	0%	100%	100%	0%	0%
Florida	47.8%	0%	47.8%	0%	0%	0%	0%	0%	0%	0%
Georgia	81.9%	0%	81.9%	0%	0%	0%	0%	0%	0%	0%
Hawaii	82.2%	0%	82.2%	0%	0%	0%	0%	0%	0%	0%
Idaho	66.2%	0%	66.2%	0%	0%	0%	0%	0%	0%	0%
Illinois	43.6%	0%	43.6%	0%	0%	0%	0%	0%	0%	0%
Indiana	100.0%	0%	100.0%	0%	0%	0%	100%	0%	0%	0%
Iowa	42.7%	0%	42.7%	0%	0%	0%	0%	0%	0%	0%
Kansas	55.2%	0%	55.2%	0%	0%	0%	0%	0%	0%	0%
Kentucky	64.6%	0%	64.6%	0%	0%	0%	0%	0%	0%	0%

State	Percent of Child Care Facilities Eligible for Waiver for:		Percent of Public Elementary Schools Eligible for Waiver for:		Percent of Private Elementary Schools Eligible for Waiver for:		Percent of Public Secondary Schools Eligible for Waiver for:		Percent of Private Secondary Schools Eligible for Waiver for:	
	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on
	pp_childcare_mand_waiver	*pp_childcare_onreq_waiver*	*pp_pub_elem_mand_waiver*	*pp_pub_elem_onreq_waiver*	*pp_priv_elem_mand_waiver*	*pp_priv_elem_onreq_waiver*	*pp_pub_second_onreq1_waiver*	*pp_pub_second_onreq2on_waiver*	*pp_priv_second_onreq1_waiver*	*pp_priv_second_onreq2on_waiver*
Louisiana	57.7%	0%	57.7%	0%	0%	0%	0%	0%	0%	0%
Maine	95.0%	0%	95.0%	0%	0%	0%	0%	0%	0%	0%
Maryland	57.2%	0%	100.0%	100%	100%	100%	100%	100%	100%	100%
Massachusetts	100.0%	0%	100.0%	0%	0%	0%	0%	0%	0%	0%
Michigan	63.2%	0%	63.2%	0%	0%	0%	0%	0%	0%	0%
Minnesota	66.7%	0%	100.0%	100%	0%	0%	100%	100%	0%	0%
Mississippi	59.5%	0%	59.5%	0%	0%	0%	0%	0%	0%	0%
Missouri	85.9%	0%	100.0%	100%	100%	100%	100%	100%	100%	100%
Montana	100.0%	0%	100.0%	100%	100%	100%	100%	100%	100%	100%
Nebraska	81.6%	0%	81.6%	0%	0%	0%	0%	0%	0%	0%
Nevada	72.2%	0%	72.2%	0%	0%	0%	0%	0%	0%	0%
New Hampshire	100.0%	100%	100.0%	0%	0%	0%	0%	0%	0%	0%
New Jersey	100.0%	100%	100.0%	100%	0%	0%	100%	100%	0%	0%
New Mexico	69.9%	0%	69.9%	0%	0%	0%	0%	0%	0%	0%
New York	44.1%	0%	100.0%	100%	0%	0%	100%	100%	0%	0%
North Carolina	100.0%	100%	100.0%	0%	0%	0%	100%	0%	0%	0%
North Dakota	37.7%	0%	37.7%	0%	0%	0%	0%	0%	0%	0%
Ohio	46.6%	0%	46.6%	0%	0%	0%	0%	0%	0%	0%
Oklahoma	100.0%	0%	100.0%	0%	0%	0%	0%	0%	0%	0%

State	Percent of Child Care Facilities Eligible for Waiver for:		Percent of Public Elementary Schools Eligible for Waiver for:		Percent of Private Elementary Schools Eligible for Waiver for:		Percent of Public Secondary Schools Eligible for Waiver for:		Percent of Private Secondary Schools Eligible for Waiver for:	
	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on
	pp_childcare_mand_waiver	*pp_childcare_onreq_waiver*	*pp_pub_elem_mand_waiver*	*pp_pub_elem_onreq_waiver*	*pp_priv_elem_mand_waiver*	*pp_priv_elem_onreq_waiver*	*pp_pub_second_onreq1_waiver*	*pp_pub_second_onreq2on_waiver*	*pp_priv_second_onreq1_waiver*	*pp_priv_second_onreq2on_waiver*
Oregon	100.0%	100%	100.0%	100%	0%	0%	100%	100%	0%	0%
Pennsylvania	100.0%	0%	100.0%	100%	0%	0%	100%	100%	0%	0%
Rhode Island	100.0%	0%	100.0%	0%	0%	0%	0%	0%	0%	0%
South Carolina	55.8%	0%	55.8%	0%	0%	0%	0%	0%	0%	0%
South Dakota	87.7%	0%	87.7%	0%	0%	0%	0%	0%	0%	0%
Tennessee	43.1%	0%	43.1%	0%	0%	0%	0%	0%	0%	0%
Texas	51.6%	0%	51.6%	0%	0%	0%	0%	0%	0%	0%
Utah	100.0%	0%	100.0%	0%	100%	0%	100%	0%	100%	0%
Vermont	100.0%	100%	100.0%	100%	100%	100%	100%	100%	100%	100%
Virginia	43.1%	0%	43.1%	0%	0%	0%	0%	0%	0%	0%
Washington	100.0%	100%	100.0%	100%	0%	0%	100%	100%	0%	0%
West Virginia	67.8%	0%	67.8%	0%	0%	0%	0%	0%	0%	0%
Wisconsin	50.2%	0%	50.2%	0%	0%	0%	0%	0%	0%	0%
Wyoming	57.6%	0%	57.6%	0%	0%	0%	0%	0%	0%	0%

Source: "School_Child Care Inputs_Final.xlsx," worksheet, "Waiver Eligibility_LCRR."

Exhibit 3-73: Percent of Schools and Child Care Facilities Eligible for Waivers under the Final LCRI based on State Regulations and WIIN Grant Funding

State	Percent of Child Care Facilities Eligible for Waiver for:		Percent of Public Elementary Schools Eligible for Waiver for:		Percent of Private Elementary Schools Eligible for Waiver for:		Percent of Public Secondary Schools Eligible for Waiver for:		Percent of Private Secondary Schools Eligible for Waiver for:	
	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on
	pp_childcare_mand_waiver	*pp_childcare_onreq_waiver*	*pp_pub_elem_mand_waiver*	*pp_pub_elem_onreq_waiver*	*pp_priv_elem_mand_waiver*	*pp_priv_elem_onreq_waiver*	*pp_childcare_mand_waiver*	*pp_childcare_onreq_waiver*	*pp_pub_elem_mand_waiver*	*pp_pub_elem_onreq_waiver*
Alabama	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Alaska	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Arizona	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Arkansas	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
California	100%	0%	96%	0%	0%	0%	0%	0%	0%	0%
Colorado	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Connecticut	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Delaware	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
District of Columbia	100%	100%	100%	100%	0%	0%	100%	100%	0%	0%
Florida	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Georgia	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Hawaii	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Idaho	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Illinois	95%	0%	95%	0%	0%	0%	0%	0%	0%	0%
Indiana	100%	0%	100%	0%	0%	0%	100%	0%	0%	0%
Iowa	93%	0%	93%	0%	0%	0%	0%	0%	0%	0%
Kansas	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Kentucky	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%

State	Percent of Child Care Facilities Eligible for Waiver for:		Percent of Public Elementary Schools Eligible for Waiver for:		Percent of Private Elementary Schools Eligible for Waiver for:		Percent of Public Secondary Schools Eligible for Waiver for:		Percent of Private Secondary Schools Eligible for Waiver for:	
	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on
	pp_childcare_mand_waiver	*pp_childcare_onreq_waiver*	*pp_pub_elem_mand_waiver*	*pp_pub_elem_onreq_waiver*	*pp_priv_elem_mand_waiver*	*pp_priv_elem_onreq_waiver*	*pp_childcare_mand_waiver*	*pp_childcare_onreq_waiver*	*pp_pub_elem_mand_waiver*	*pp_pub_elem_onreq_waiver*
Louisiana	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Maine	100%	0%	100%	0%	100%	0%	100%	0%	100%	0%
Maryland	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%
Massachusetts	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Michigan	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Minnesota	100%	0%	100%	100%	0%	0%	100%	100%	0%	0%
Mississippi	100%	0%	98%	0%	0%	0%	0%	0%	0%	0%
Missouri	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%
Montana	100%	0%	100%	100%	100%	100%	100%	100%	100%	100%
Nebraska	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Nevada	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
New Hampshire	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%
New Jersey	100%	100%	100%	100%	0%	0%	100%	100%	0%	0%
New Mexico	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
New York	96%	0%	100%	100%	0%	0%	100%	100%	0%	0%
North Carolina	100%	100%	100%	0%	0%	0%	100%	0%	0%	0%
North Dakota	83%	0%	83%	0%	0%	0%	0%	0%	0%	0%
Ohio	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Oklahoma	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Oregon	100%	100%	100%	100%	0%	0%	100%	100%	0%	0%

State	Percent of Child Care Facilities Eligible for Waiver for:		Percent of Public Elementary Schools Eligible for Waiver for:		Percent of Private Elementary Schools Eligible for Waiver for:		Percent of Public Secondary Schools Eligible for Waiver for:		Percent of Private Secondary Schools Eligible for Waiver for:	
	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on	1st 5-yr cycle	2nd 5-yr cycles on
	pp_childcare_mand_waiver	*pp_childcare_onreq_waiver*	*pp_pub_elem_mand_waiver*	*pp_pub_elem_onreq_waiver*	*pp_priv_elem_mand_waiver*	*pp_priv_elem_onreq_waiver*	*pp_childcare_mand_waiver*	*pp_childcare_onreq_waiver*	*pp_pub_elem_mand_waiver*	*pp_pub_elem_onreq_waiver*
Pennsylvania	100%	0%	100%	100%	0%	0%	100%	100%	0%	0%
Rhode Island	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
South Carolina	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
South Dakota	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Tennessee	93%	0%	93%	0%	0%	0%	0%	0%	0%	0%
Texas	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Utah	100%	100%	100%	0%	100%	0%	100%	0%	100%	0%
Vermont	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Virginia	94%	0%	94%	0%	0%	0%	0%	0%	0%	0%
Washington	100%	100%	100%	100%	0%	0%	100%	100%	0%	0%
West Virginia	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Wisconsin	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%
Wyoming	100%	0%	100%	0%	0%	0%	0%	0%	0%	0%

Source: "School_Child Care Inputs_Final.xlsx," worksheet, "Waiver Eligibility_LCRI."

3.3.10.2.3 Discussion of Data Limitations and Uncertainty

There is uncertainty in the use of WIIN grant allocations for estimating the percentage of public elementary schools and child care facilities that will be tested in the first five-year cycle. The amount of available funding is based on the amounts appropriated in the BIL, recognizing that the full appropriated amount may not be allocated. The EPA projected the amount of WIIN grant funding that would be available for FY 2024 through FY 2026 based on the allocation for FY 2023. To try to reduce the uncertainty in the number of facilities that could be tested using this WIIN grant funding, the EPA developed low and high estimates per sampling event and used the average. The EPA assumed in this analysis that States will use funding in the year it is awarded, but there is uncertainty in when a State will use the grant funding. There is also uncertainty in how a State decides to spend its funding. There is further uncertainty in the number of samples per school and in the use of data that include secondary schools. There is also uncertainty in the voluntary participation of a school or child care facility in the testing program.

3.3.11 Labor Rates

This section is divided into three subsections:

- Section 3.3.11.1: presents PWS labor rates,
- Section 3.3.11.2: presents State labor rates, and
- Section 3.3.11.3: provides a discussion of data limitations and uncertainty associated with the labor rates.

3.3.11.1 Public Water System Labor Rates

The EPA recognizes that there may be variation in labor rates across all systems. However, for purposes of this EA, the EPA used national-level estimates from *Labor Costs for National Drinking Water Rules* (USEPA, 2020c) with a few modifications, as described below.

The 2020 document evaluated three data sources for labor rates:

- The 2019 Occupational Employment Survey (OES), a semi-annual U.S. Bureau of Labor Statistics (BLS) survey that provides hourly wage estimates by occupation and industry (U.S. Bureau of Labor Statistics, 2020).
- The 2019 Water Utility Compensation Survey, an annual AWWA survey that provides hourly wage estimates for the water and wastewater industry by occupation. Data are in 2008 dollars (AWWA, 2019a, 2019b, 2019c).
- The 2006 CWSS, a periodic EPA survey that obtains employment information from a sample of CWSs. Wage rates are escalated from 2007 to 2019 dollars using an employment cost index (USEPA, 2009).

In 2020, the EPA evaluated these data sources against suitability criteria (see Exhibit 3-74) (USEPA, 2020c).[83] The EPA determined that the 2006 CWSS was the most suitable source for labor rates associated with national drinking water rules particularly because: the data are specific to drinking water; the survey responses can be extrapolated to national estimates since the survey has a known sampling framework; and the data can be organized by system size, source, and ownership (USEPA, 2020c).

Exhibit 3-74: Comparison of Wage Rate Surveys

Suitability Criteria	OES (BLS)(2019)	AWWA (2019)	2006 CWSS
National average wage rates	Yes Annual updates available	No Sample of systems serving <10,000 people may not be representative of all small systems Annual updates available	Yes Updates are periodic
Data quality	High Statistically precise wage estimates	Unknown Sampling procedures unknown; no information on statistical precision of wage estimates	Moderate Low item response rates among small systems lead to large confidence intervals
Drinking water industry data	No[1]	Yes	Yes
Management, Technical, and Administrative occupations	Yes	No administrative occupation to match WBS needs for medium or large systems	Administrative occupation may differ from WBS needs
System size differentiation	No	Yes	Yes
Source water differentiation	No	No	Yes Estimates are not statistically significantly different across source waters
Ownership differentiation	No	No	Yes Estimates are not statistically significantly different across private and public ownership

Acronyms: AWWA = American Water Works Association; CWSS = Community Water System Survey; BLS = Bureau of Labor Statistics; OES = Occupational Employment Survey; WBS = work breakdown structure.
Source: From Exhibit ES-1 (USEPA, 2020c).
Notes:
[1] OES data are available for two North American Industry Classification System (NAICS) categories that are likely to contain drinking water systems: 221300 (Water, Sewage, and Other Systems) for private water systems and 999300 (Local Government) for PWSs.

[83] Note that, based on publicly available information, the EPA did not find significant survey reporting updates in more recent OES or AWWA surveys; therefore, the comparisons between these 2019 surveys and the CWSS are still accurate.

Exhibit 3-75 presents the labor rate estimates used in USEPA (2020b) in 2019 dollars. Labor rates were calculated for three occupation categories: manager, treatment plant operator, and administrative personnel. The rates include benefits. The EPA considered benefit multipliers from BLS and the 2006 CWSS. Benefit multipliers from BLS ranged from 1.3 to 1.5, and benefit multipliers from the 2006 CWSS ranged from 1.2 to 1.4. The BLS estimates are more precise than the 2006 CWSS estimates, but information was not available at the industry level. The CWSS estimates are related to the drinking water industry but have large confidence intervals and low precision. Ranges from both sources overlapped at 1.4; however, the EPA used a benefit multiplier of 1.45 because updated BLS data for industries and occupations that include water treatment utilities showed that State and Local Government benefits were 0.11 - 0.13 points higher in 2019 compared to 2006. A benefit multiplier of 1.45 is the current multiplier for all civilians working in service-producing industries (USEPA, 2020c).

The EPA used the employment cost index (ECI) to escalate wage rates and convert dollar values to 2019 dollars. To adjust the managerial wage rates from 2007 to 2019 dollars, the EPA used the ECI escalation rate of 149.6/104.5, or 43%. The EPA did not use the 43% ECI escalation rate for technical wage rates because it appeared to overstate growth in technical rates for operator and maintenance activities compared to the OES and AWWA data, particularly among larger systems (USEPA, 2020c). It also overstated growth in administrative rates.[84] The EPA accounted for this variation by escalating the CWSS value for technical and administrative wage rates to 2019 dollars using the OES change in mean wage rate from 2007 to 2019. The EPA used a revised escalation value of 32.1% for the technical rate and an escalation value of 33% for the administrative rate.

Exhibit 3-75: Hourly Labor Costs Including Wages Plus Benefits (2019$)

System Size (Population Served)	Hourly Labor Cost by Occupation		
	Manager	Treatment plant operator	Administrative personnel
≤500	$48.20	$32.51	$31.31
501-3,300	$48.20	$32.51	$31.31
3,301-10,000	$55.13	$34.67	$31.31
10,001-50,000	$61.41	$36.60	$40.43
50,001-100,000	$71.66	$38.21	$40.43
>100,000	$76.56	$44.66	$40.43

Source: Labor Costs for National Drinking Water Rules (USEPA, 2020c), Exhibit 3-5, which is based on 2006 CWSS (USEPA, 2009).

To account for the general composition of staff at systems of smaller sizes, (*i.e.*, those serving 3,300 or fewer people), the EPA used only the technical rate (*i.e.*, treatment plant operator rate). For systems serving more than 3,300 people, the EPA used proportions of 80 percent technical labor and 20 percent managerial labor (*i.e.*, manager rate) to arrive at a labor cost, or weighted labor rate. The actual proportions between technical and managerial rates employed may vary by PWS and among the different compliance activities under the final LCRI. However, for simplicity, the EPA used the 80/20

[84] The EPA determined that the CWSS wage rates for technical workers (USEPA, 2009) escalated using the ECI were 4 to 14 percent higher than the wage rates in the OES survey (United States Bureau of Labor Statistics, 2018) and the AWWA surveys (AWWA, 2019a; 2019b; 2019c). The analysis is described in Chapter 3 of *Labor Costs for National Drinking Water Rules* (USEPA, 2020c).

proportions as a general assumption to develop system labor costs for this EA. This approach for developing system labor rates is consistent with that used for other economic analyses, such as the Revised Total Coliform Rule (USEPA, 2012b). The EPA further adjusted the labor rates from 2019 dollars to 2020 dollars using an ECI escalation rate of 140.7/137.0 for all labor categories. The final labor rates used in this EA are in column D in Exhibit 3-76 below and are used for both CWSs and NTNCWSs. The final labor rates used in this EA are in column D in Exhibit 3-76 below.

Exhibit 3-76: Weighted Labor Rates for CWSs and NTNCWSs

System Size (Population Served)	Technical Labor Rate (2019$/hour)	Managerial Labor Rate (2019$/hour)	Weighted System Labor (2019$/hour)	Weighted System Labor Adjusted to 2020$ (2020$/hour)
	A	B	C = A for PWSs ≤ 3,300); C = (0.8*A) + (0.2*B) for PWSs > 3,300	D = C*(140.7/137.0)
≤3,300	$32.51	$48.20	$32.51	$33.39
3,301-10,000	$34.67	$55.13	$38.76	$39.81
10,001-50,000	$36.60	$61.41	$41.56	$42.68
50,001-100,000	$38.21	$71.66	$44.90	$46.11
>100,000	$44.66	$76.56	$51.04	$52.42

Sources: A, B: Labor Costs for National Drinking Water Rules (USEPA, 2020c), Exhibit 3-5. Hourly labor costs include wages and benefits. Technical labor wage rates are based on wage rates for treatment plant operators.

Notes:

General: Labor rates for each size category are assumed to be the same regardless of system type (CWSs or NTNCWSs). In general, information in this chapter is presented by the nine size categories used in the SafeWater LCR model. In this exhibit, the EPA merged size categories with the same hourly rate.

C: The EPA estimates that systems serving 3,300 people or fewer use 100 percent technical labor, whereas systems serving more than 3,300 use 80 percent technical (operator) labor and 20 percent managerial (engineer) labor.

D: The weighted system hourly rate was adjusted to 2020 dollars using the general employment cost index (ECI) seasonally adjusted June for 2019 (137.0) and June 2020 (140.7), as shown in the file, "General Cost Model Inputs_Final," worksheet, "ECI Table 1."

3.3.11.2 State Labor Rates

The EPA used the hourly mean State employee labor rate from the BLS May 2020 Occupational and Employment Wages (OEWS) table. Specifically, the EPA used the hourly labor rate from the category "19-2041 Environmental Scientists and Specialists, Including Health" as an approximation for the State labor rate. Within that category, the EPA used the hourly mean wage for State Government, excluding schools and hospitals. This approximation is a reasonable estimate because the majority of primacy agencies are States. The base hourly State labor rate is $33.91 in 2020 dollars. The EPA further adjusted the labor rate using a 1.62 loading factor that reflects additional employee benefits from the BLS Employer Costs for Employee Compensation report, "Table 1. Employer Costs for Employee Compensation by Ownership (June 2020)." (See worksheet "BLS Table 1" in the file, "General Cost Model Input_Final.xlsx" for additional information.) The final "loaded" hourly rate of $54.78 is used for the State labor rate in the SafeWater LCR model and is designated with the data variable name of

rate_js. Calculations and the loaded labor rate are shown in the Exhibit 3-77 (also see "General Cost Model Inputs_Final," worksheet, "State Labor Rates").[85]

Exhibit 3-77: Loaded Labor Rate for State Staff (2020$)

Base Hourly Labor Cost	Loading Factor	Loaded Hourly Labor Rate (2020$)
		rate_js
A	**B**	**C = A*B**
$33.91	1.62	**$54.78**

Sources:
A: State employee wage rates from National Occupational Employment and Wage Estimates, United States, BLS SOC Code 19-2041, "State Government - Environmental Scientists and Specialists, Including Health," hourly mean wage rate for "State Government, excluding schools and hospitals (OEWS Designation)." May 2020 data: https://www.bls.gov/oes/current/oes192041.htm. See worksheet OES in the file, "General Cost Model Input_Final.xlsx," worksheet "State Labor Rates."
B: Wages are loaded using a factor from the BLS Employer Costs for Employee Compensation by Ownership, Table 1, June 2020. State and local government workers. Percent of compensation. https://www.bls.gov/news.release/archives/ecec_09172020.htm. See "General Cost Model Input_Final.xlsx," worksheet, "BLS Table 1."

3.3.11.3 Discussion of Data Limitations and Uncertainty

There is uncertainty in the derivation of water system labor rates that could result in an over or underestimate of national costs of the final LCRI. The wage rates are based on the 2006 CWSS data and escalated to a particular dollar year using an ECI. The labor rate mix may have changed since the time of the survey. Moreover, the labor rate used is a national average and does not capture differences across regions or between urban and rural areas. The EPA accounted for general changes in the cost of labor over time by adjusting 2007 values to 2020 using the ECI.

Additionally, the wage rates based on the 2006 CWSS data values were found to overstate labor costs for technical and administrative labor when compared to the OES and AWWA surveys. The EPA revised the escalation rate from the ECI-based value using the OES change in mean wage rate from 2007 to 2019 for technical and administrative wage rates to account for variation. For managerial hours, the wages did not clearly over- or understate wages compared to OES data, but were consistently lower than AWWA wage estimates.

There is also uncertainty in assuming a 1.45 benefits multiplier and that a labor mix of 80/20 technical/managerial staff will apply to activities conducted by CWSs and NTNCWSs serving more than 3,300 people. There may be situations where an activity is performed just by technical staff, *e.g.,* sample

[85] Note that although the EPA used more current BLS information for this economic analysis, the State labor rate is lower than the one used to estimate costs for the final 2021 LCRR of $57.24 (2016$). This is because for the final 2021 LCRR economic analysis (USEPA, 2020a), the EPA used the hourly mean wage for all employees in the category of "Environmental Scientist and Specialists, Including Health from the May 2016 Occupational and Employment Wage" information from the BLS, which yielded a base labor hourly labor rate of $36.23 (2016$). For the current economic analysis, the EPA revised this estimate to use the subcategory that most closely approximates State primacy agencies labor costs.

analysis, or just by managerial staff, *e.g.*, reporting. This may cause an under or overestimation of cost of the final LCRI.

Similarly, there is uncertainty in the derivation of the State labor rate that could result in an over or underestimation of national cost. The EPA tried to reduce the uncertainty by using the base hourly labor rate of the subcategory "State Government, excluding schools and hospitals," within the larger labor category of an "Environmental Scientists and Specialists, Including Health", as opposed to using the average from the larger category, as was done for the Final 2021 LCRR EA. Some of the activities undertaken by the State may include support staff, more technical staff, or management staff that have a lower or higher base rate. There is also uncertainty in assuming an average State employee hourly labor rate includes a loading factor of 1.62. This factor, provided by BLS, is an average across all State and local governments and job categories. This assumption could result in an under or overestimation of the State labor costs estimated for the final LCRI.

3.4 Uncertainties in the Baseline and Compliance Characteristics of Systems

Uncertainties in the baseline and compliance characteristics of PWSs, which can apply to systems under the pre-2021 LCR, 2021 LCRR, and final LCRI analysis, are due to the limits of available information. The largest sources of uncertainty include the following three variables: 1) the number of PWSs that will exceed the AL under the revised tap sampling requirements, 2) the cost of service line replacement, and 3) the cost of CCT treatment. The EPA is using low and high scenarios defined by the assignment of low and high values listed above to assess the potential impact of these uncertain variables on the costs and benefit of the final LCRI. Detailed descriptions of the uncertain variables and the derivation of their values can be found in Chapter 4, Section 4.2.2.

In addition to the uncertainty, which is represented in the cost range, the EPA acknowledges that there are other uncertainties associated with the inputs to the cost-benefit model. The EPA has described these uncertainties related to system characteristics throughout the text in this chapter and Exhibit 3-78 provides a summary of these uncertainties.

Exhibit 3-78: Summary of Uncertainties in the Baseline and Compliance Characteristics of Drinking Water Systems

Uncertainty Description	Effect on Costs	Effect on Benefits	Relevant Section(s)
System and CCT Characterization			
For PWSs with unknown source type, uncertainty in assigning source type based on the ratio of systems with known primary GW or SW sources.	+/-	+/-	3.3.1
Uncertainty associated with changing population demographics including fertility and immigration rates, and within country migration affecting the number and size of PWSs	+/-	+/-	3.3.1 3.3.2
Uncertainty in using 2020 census data on average persons per household to estimate number of households served by CWSs.	+/-	+/-	3.3.2

Uncertainty Description	Effect on Costs	Effect on Benefits	Relevant Section(s)
Uncertainty in using retail population to predict average daily flow per PWS in situations where the PWS is a wholesale system that sells water to a consecutive PWS.	+	None	3.3.2
Uncertainty in assuming that all PWSs serving 50,000 or more except "b3" systems[1] have CCT. For those serving 50,000 or fewer, uncertainty in using SDWIS/Fed treatment data to estimate percent with CCT.	+/-	+/-	3.3.3
Uncertainty in assuming that flow is proportioned equally among all entry points in a given system.	+/-	+/-	3.3.6
Uncertainty in using historical CWSS data as analyzed in the Geometries document (USEPA, 2000) to predict population/flow relationships given water efficiency trends over the last 20 years.	+	None	3.2.4 3.3.6
Uncertainty in estimated percent of PWSs with pH adjustment only, orthophosphate only, or both based on SDWIS/Fed historical data. Uncertainty in using SYR3 ICR dataset to estimate baseline pH and orthophosphate concentration.	+/-	+/-	3.3.6
Uncertainty in average daily flow used to estimate CCT costs due to the fact that household water use has generally declined over the period since this analysis was completed.	+	None	3.2.4
Lead Service Line Characterization			
For CWSs, uncertainty in the extent of unknowns in the service line material characterization that are lead or non-lead.	+/-	+/-	3.2.5 3.3.4.1
For NTNCWS, uncertainty in using data from two States to estimate percent of systems with LSLs. Uncertainty in assumptions related to percent of connections that are lead within NTNCWSs that are known to have LSLs.	+/-	+/-	3.3.4.2
Uncertainty in using historical SDWIS/Fed 90th percentile data from 2012-2020 to predict future 90th percentile lead levels and percent of systems with no ALE and an ALE under the final LCRI conditions. Includes adjustments for the final LCRI requirement for LSL systems to collect all samples from locations served by an LSL and to use the higher of the 1st and 5th liter sample in the 90th percentile calculation.	+/-	+/-	3.2.1 3.3.5.1
Uncertainty in using a subset of CWSs with known LSL status to predict future 90th percentile values.	+/-	+/-	3.3.5.1

Uncertainty Description	Effect on Costs	Effect on Benefits	Relevant Section(s)
Uncertainty in using data from a single State (Michigan) to estimate the impact on the lead 90th percentile levels that will be based on fifth-liter vs. first-liter samples under the final LCRI for LSL systems.	+/-	+/-	3.2.7 3.3.5.1
Uncertainty in using historical SDWIS/Fed 90th percentile data from 2012-2020 to predict future 90th percentile lead levels and percent of systems that will have at least two or three lead ALEs in a five-year period.	+/-	+/-	3.2.1 3.3.5.2
Uncertainty in basing the likelihood of a sample exceeding 10 µg/L based on data from a single State (Michigan).	+/-	+/-	3.2.7 3.3.5.3
Uncertainty in basing the likelihood a system has a copper ALE based on historical copper 90th data reported for 2012 – 2020.	+/-	+/-	3.3.5.4
Lead and WQP Monitoring Schedules			
Uncertainty in using schedule based on historical P90, Cu90, milestone, treatment, and violation data from SDWIS/Fed to estimate initial WQP schedules under the final LCRI.	+/-	+/-	3.3.8.2
Change in Source or Treatment			
Uncertainty in using historical information on source water type from SDWIS/Fed to estimate the percent of systems that will change source each year. May underestimate costs by not counting when the same type of source was added and removed at a system in a given year.	-	+/-	3.2.1 3.3.9.1
Uncertainty in using historical treatment code data from SDWIS/Fed to estimate the percent of systems making a treatment change each year.	+/-	+/-	3.2.1 3.3.9.3
Schools, Child Care Facilities, Local Health Departments, and Targeted Medical Providers			
Uncertainty in number of schools based on NCES data for 2018-2020 (NCES, 2020a, 2020b) and in the number of child care facilities based on the 2019 update to a report by the Committee for Economic Development (CED, 2019 due to population growth.	-	None	3.2.8.1 3.3.10.1.1
Uncertainty in number of child care facilities based on 2019 industry statistics (CED, 2019) due to potential inclusion of unlicensed at-home facilities.	+	None	3.2.8.2 3.3.10.1.2

Uncertainty Description	Effect on Costs	Effect on Benefits	Relevant Section(s)
Uncertainty in identification of local health agencies number based on 2016 statistics (NACCHO, 2017).	No effect on incremental costs. Requirement to deliver to this group is the same under the pre-2021 LCR, 2021 LCRR, and final LCRI.	None	3.2.8.3 3.3.10.1.3
Possible overestimation of States that may grant waivers to CWSs for sampling in schools and child care facilities based on the assumed use of WIIN grant funding.	-	None	3.3.10.2.2
Labor Rates			
Uncertainty in using 2006 CWSS data for PWS labor rates, 1.45 benefits multiplier, and 80/20 technical/managerial staffing mix for PWSs serving more than 3,300 people.	+/-	None	3.3.11.1
Uncertainty in basing the State labor rate on the wage rate category for Environmental Scientists and Specialists (activities may be done by staff with higher or lower rates) and uncertainty in using a single benefits loading factor of 1.62 for employee compensation.	+/-	None	3.3.11.2

Acronyms: ALE = action level exceedance; CED = Committee for Economic Development; CCT = corrosion control treatment; CWS = community water system; CWSS = Community Water System Survey; LCRR = Lead and Copper Rule Revisions; LSL = lead service line; NACCHO = National Association of County and City Health Officials; NCES = National Center for Education Statistics; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile value; PWS = public water system; SDWIS/Fed = Safe Drinking Water Information System – Federal version; SYR3 ICR = Six-Year Review 3 Information Collection Request.

Notes:

General: This exhibit indicates whether each uncertainty factor contributes to understating (-), overstating (+), or either understating or overstating (+/-) the overall economic impact results.

[1] Excluded 16 CWSs serving 50,000 that were assumed to meet the b3 criteria, *i.e.*, have naturally non-corrosive water, and under the pre-2021 LCR are not required to install CCT. See Section 3.3.3 for additional information.

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4 Economic Impact and Cost Analysis of the Final Lead and Copper Rule Improvements

4.1 Introduction

The final Lead and Copper Rule Improvements (LCRI) accelerates the removal of lead and certain galvanized service lines and reduces the lead action level to 0.010 mg/L. The final LCRI also strengthens tap sampling procedures, corrosion control treatment (CCT), public education and consumer awareness, requirements for small systems, and sampling in schools and child care facilities. In this chapter, the EPA presents its estimates of, and approach to estimate, the national incremental cost of the final LCRI. To determine the incremental national cost of the final LCRI, the EPA estimated the additional costs that public water systems (PWSs), households, and primacy agencies (note: this document uses "States" to refer generally to primacy agencies) will incur in response to the final LCRI, above the cost they would face under the 2021 Lead and Copper Rule Revisions (LCRR) if the LCRI was not enacted. To determine the incremental cost of the final LCRI, the agency first calculated the costs that would be incurred in continuing to comply with the 2021 LCRR. Next, the agency estimated the cost that PWSs, households, and States would incur in response to the final LCRI if no 2021 LCRR requirements were currently in place. Under both the 2021 LCRR and the LCRI, the EPA removed those lead and galvanized requiring replacement (GRR) service line replacements that would occur in the baseline as a result of State service line replacement (SLR) requirements.[86] The incremental national cost of the final LCRI is the difference between the cost of compliance with the final LCRI and the cost of compliance with the 2021 LCRR.

Note that the incremental national costs of the final LCRI when compared to the pre-2021 Lead and Copper Rule (LCR) have also been computed and are provided in Appendix C. Appendix B also explains how the EPA developed the cost values for the pre-2021 LCR, which were subtracted from the final LCRI costs to produce the incremental cost of moving from the pre-2021 LCR to the final LCRI requirements.

4.1.1 Summary of Rule Costs

The annualized costs, discounted at 2 percent, that PWSs, households, and States will incur in complying with the 2021 LCRR and the final LCRI are summarized in Exhibit 4-1. The EPA used the 2 percent discount rate as prescribed by the Office of Management and Budget's updated Circular A-4 (OMB Circular A-4, 2023).[87] See Section 4.2.3 below for additional information on discounting. The EPA estimated costs of the final LCRI under both low and high scenarios to reflect uncertainty in the cost estimates. The low scenario and high scenario differ in their assumptions made about: 1) the number of

[86] Four States (Illinois, Michigan, New Jersey, and Rhode Island) have passed state laws that require lead service line replacement (LSLR) at various rates from 2-10 percent. The EPA has included replacements associated with these programs in the baseline; therefore, the costs of replacing these LSLs do not appear in the estimated SLR costs under either the 2021 LCRR or LCRI. There are other statewide and municipal voluntary or goal-based programs to replace all LSLs within the next 10 or more years. However, because these are not legal requirements, the EPA does not include them in its estimate of the number of LSLs that would be replaced in the baseline. See Chapter 3, Section 3.3.4.3 for more information.

[87] Because the EPA provided cost estimates discounted at 3 and 7 percent for the proposed LCRI based on OMB guidance which was in effect at the time of the proposed rule analysis (OMB Circular A-4, 2003), the agency has also calculated the cost impacts at both the 3 and 7 percent discount rates. See Appendix F for results.

PWSs above the action level (AL) for the 2021 LCRR and final LCRI and trigger level (TL) for the 2021 LCRR, and final LCRI monitoring requirements; 2) the cost of installing and optimizing corrosion control treatment (CCT); and 3) the cost of SLR. The EPA discusses these assumptions in more detail below and in Section 4.2.2.

The monetized incremental annualized cost of the final LCRI ranges from $1.47 billion to $1.95 billion at a 2 percent discount rate in 2022 dollars. The exhibits also detail the proportion of the annualized costs attributable to each rule component.

Exhibit 4-1: Estimated National Annualized Rule Costs - 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS Annual Costs						
Sampling	$134.0	$166.0	$32.0	$143.6	$176.2	$32.6
PWS SLR*	$84.6	$1,259.0	$1,174.4	$124.5	$1,763.9	$1,639.4
Corrosion Control Technology	$552.0	$591.1	$39.1	$647.8	$692.9	$45.1
Point-of Use Installation and Maintenance	$2.4	$5.1	$2.7	$5.9	$9.6	$3.7
Public Education and Outreach	$69.6	$267.3	$197.7	$72.1	$302.2	$230.1
Rule Implementation and Administration	$0.1	$3.4	$3.3	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$842.7***	***$2,291.9***	***$1,449.2***	***$994.1***	***$2,948.2***	***$1,954.1***
Household SLR Costs**	$8.1	$0.0	-$8.1	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$38.4	$66.1	$27.7	$41.8	$67.6	$25.8
Wastewater Treatment Plant Costs***	$3.0	$3.0	$0.0	$4.8	$5.1	$0.3
Total Annual Rule Costs	**$892.2**	**$2,361.0**	**$1,468.8**	**$1,067.1**	**$3,020.9**	**$1,953.8**

Acronyms: LCRI = Lead and Copper Rule Improvements; SLR = service line replacement; PWS = public water system; USD = United States dollar.
Notes: Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.
*SLR includes full and partial LSLs and GRR service lines.

**In the *Economic Analysis for the Final Lead and Copper Rule Revisions* (USEPA, 2020), the EPA assumed that the cost of customer-side SLRs made under the goal-based replacement requirement would be paid for by households. The agency also assumed that system-side SLRs under the goal-based replacement requirement and all SLRs (both customer-side and systems-side) would be paid by the PWS under the 3 percent mandatory replacement requirement. The EPA made these modeling assumptions based on the different levels of regulatory responsibility systems faced operating under a goal-based replacement requirement versus a mandatory replacement requirement. While systems would not be subject to a potential violation for not meeting the replacement target under the goal-based replacement requirement, under the 3 percent mandatory replacement requirement the possibility of a violation could motivate more systems to meet the replacement target even if they had to adopt customer incentive programs that would shift the cost of replacing customer-side service lines from customers to the system. To be consistent with these LCRR modeling assumptions, under the final LCRI, the EPA assumed that mandatory replacement costs would fall only on systems. Therefore, the negative incremental values reported for the "Household SLR Costs" category do not represent a net cost savings to households. They represent an assumed transfer of the estimated SLR costs from households to systems. The EPA has insufficient information to estimate the actual SLR cost sharing relationship between customers and systems at the national level of analysis.
***Due to many water systems operating both the wastewater and drinking water systems, the EPA is evaluating the costs of additional phosphate usage for informational purposes. These costs are not "likely to occur solely as a result of compliance" with the final LCRI, and therefore are not costs considered as part of the HRRCA under SDWA, section 1412(b)(3)(C)(i)(III).

OMB Circular A-4 (OMB, 2023) defines a "transfer" as: ". . . a shift in money (or other item of value) from one party to another. More generally, when a regulation generates a gain for one group and an equal-dollar-value loss for another group, the regulation is said to cause a transfer from the latter group to the former." The final LCRI has both known transfers and potential transfers associated with the implementation of the rule's requirements. The transfers discussed here do not affect the estimated total monetized annualized social costs of the final LCRI. Tracking these transfers helps the agency understand the distributional impact of costs across affected groups.

Implementation of the final LCRI will result in inter-community transfers, which is defined as the shift in cost burden associated primarily with inventory development, and lead and GRR service line replacement from the PWS and the community it serves, including customers whose private side lead or GRR service lines were replaced, to an outside entity or group.

Congress enacted the Infrastructure Investment and Jobs Act (Pub. L. 117-58), also referred to as the Bipartisan Infrastructure Law (BIL), which included $15 billion specifically appropriated for lead service line replacement (LSLR) projects and associated activities directly connected to the identification and replacement of LSLs. The BIL also included over $11.7 billion for the Drinking Water State Revolving Fund (DWSRF) General Supplemental, which can be used for LSLR as well as other drinking water projects. The $15 billion in specified LSLR BIL funding, when used by PWSs to pay for service line replacement (SLR), represents a transfer of the payment burden from the community or individuals in the community to the federal taxpayer at large. Also, to the extent systems utilize the other $11.7 billion in BIL funds or other DWSRF base appropriation funds to conduct both system and private side SLR, the payment burden of these LCRI activities will transfer from the implementing community to the federal taxpayer. The use of funds from other federal programs like the EPA's Water Infrastructure Improvements for the Nation Act of 2016 (WIIN Act) grant programs, the American Rescue Plan, Community Development Block Grant programs through the U.S. Department of Housing and Urban Development, Rural Development through the U.S. Department of Agriculture, and the Public Works Program through the U.S. Department of Commerce Economic Development Administration for LCRI implementation will

result in the same type of transfers. But apart from information on the American Rescue Plan's budgeted $519 million to remediate lead in drinking water, as of April 2024 (USDT, 2024), the EPA does not have estimates on the amount of funds that will be used under these programs. Inter-community transfers my also occur at the State or regional level. States may adopt programs to support lead and GRR service line replacement (e.g., the State of Minnesota has approved $240 million for replacing LSLs, mapping and inventory activities, and informing residents about the benefits of LSLR, and New York State in the past has provided New York City with $30 million in LSLR funding) which would result in a transfer from the State taxpayer base to LCRI implementing communities.

The implementation of the final LCRI also has the potential to result in intra-community transfers, which is a shift in cost burden associated primarily with lead and GRR service line replacement from the private side owner of the service lines to other community members, in this case the PWS which will likely seek to recoup the cost by raising water rates on some or all of its customers. Note, that although the EPA strongly encourages water systems to offer full-service line replacement at no cost to the customer; SDWA does not provide authority for the agency to direct how a water system covers the costs of compliance with a National Primary Drinking Water Regulation (NPDWR) and the EPA has not used its section 1412 authority under SDWA to do so. This is a matter of State and local law, as the State and local governments regulate how water systems provide and charge for services to their customers. At the time of rule publication, the majority of State and local authorities have not made decisions on customer/PWS cost sharing for service line replacement therefore the EPA has insufficient information to estimate the actual SLR cost sharing relationship between customers and systems at the national level of analysis. The potential size of the intra-community transfers are dependent on a number of system specific SLR program criteria including the amount or fraction of the private side SLR the system will pay for and any other income restrictions or other qualifiers associated with private side SLR participants, the rate structure in the individual system and the degree to which the cost of private side replacement will be passed through to the customers (e.g., low household income customers may not receive a rate increase in favor of increasing rates on higher household income customers), and the degree to which inter-community transfer funds are used to pay for private side replacements. After accounting for BIL funding of $15 billion, and assuming no other Federal, State, or regional funding of SLRs, the maximum incremental intra-community transfer under the LCRI associated with private side SLR would be between $7.1 billion (low scenario) and $11.4 billion (high scenario), in 2022 dollars over the 35-year period of analysis. This assumes 100 percent of private side costs are paid for by the PWS.

4.1.2 Overview of the Chapter

In Section 4.2, the EPA provides an overview of its approach to estimate the cost of the final LCRI. In Section 4.3, the EPA provides the data and algorithms used to calculate the cost of each activity that PWSs will undertake to comply with the final rule. In addition, Section 4.3 provides the EPA's estimates of these costs. In Section 4.4, the EPA provides the data and algorithms used to calculate the cost of each activity States will undertake to implement and administer the final LCRI, as well as the EPA's estimates of these costs. While this chapter includes the EPA's national cost estimates for both the 2021 LCRR and the final LCRI, only details on the approach, data, and algorithms used to calculate the costs of the final LCRI are provided in this chapter. The details on the approach, data, and algorithms used to calculate the costs of the 2021 LCRR are provided in Appendix B.

An important compliance option for PWSs is to add additional phosphate for corrosion control. Some of this phosphate may eventually enter wastewater treatment plants (WWTPs). In Section 4.5, the EPA estimates the costs and impacts associated with increased phosphorous loadings.

4.2 Overview of the SafeWater LCR Model

In order to estimate the compliance costs (and benefits) of the LCRR in 2021, the EPA developed a new version of its existing SafeWater CBX model.[88] This new version, called the SafeWater LCR model, was designed to estimate the costs and benefits of a treatment technique rule, and focus on water contamination in the distribution system. The agency has updated the SafeWater LCR model to estimate the compliance costs (and benefits) of the final LCRI.

4.2.1 Modeling PWS Variability in the SafeWater LCR Model

The SafeWater LCR model incorporates a large degree of variability across water system baseline characteristics that influence compliance and costs. For example, under the final LCRI, PWSs will face different compliance scenarios and costs depending on their size, primary source water type, number of entry points to the distribution system, number of lead service lines (LSLs) and GRR service lines in their distribution system, and existing corrosion controls in place. The SafeWater LCR model also includes variability in compliance characteristics like different labor rates and number of tap and water quality parameter (WQP) samples required by system size.

To reflect variability across PWS categories in modeling the final LCRI, the SafeWater LCR model applies a “model PWS” approach. From a set of system baseline characteristic data including system type, system size, and primary water source, the EPA defined 72 PWS categories, or strata, in the SafeWater LCR model.

The 72 PWS categories consist of each combination of PWS type (2), PWS population size category (9) PWS primary source water (2), and PWS ownership (2):

- PWS Type:
  - Community Water System
  - Non-Transient Non-Community Water System
- PWS Size Category (Population Served)
  - 25 -100
  - 101-500
  - 501-1,000
  - 1,000-3,300
  - 3,301-10,000
  - 10,001-50,000
  - 50,001-100,000
  - 100,001-1,000,000
  - Over 1,000,000

[88] Information of the development of the SafeWater CBX model and its peer review can be found in Chapter 5, Section 5.2.3 of the Economic Analysis for the Final Lead and Copper Rule Revisions (USEPA, 2020).

- PWS Primary Source Water
  - Surface Water
  - Groundwater
- PWS Ownership
  - Publicly Owned
  - Privately Owned

The SafeWater LCR model creates model PWSs representing systems in each category by combining the PWS-specific data available in the Safe Drinking Water Information System/Federal version (SDWIS/Fed) with data on baseline and compliance characteristics available at the PWS category level. When categorical data are point estimates, every model PWS in a category is assigned the same value. When the EPA has probabilistic data representing system variability, SafeWater LCR model assigns each model PWS a value sampled from the distribution. Examples of the distributional data inputs that characterize variability in the SafeWater LCR model include the burden for PWS and State staff to conduct tasks like sampling and compliance documentation and review. For additional detail on the development of model-PWSs in the SafeWater LCR model, see Appendix B, Section B.2.1. Because of this model PWS approach, SafeWater LCR does not output any results at the PWS level, but rather, outputs cost (and benefit) estimates at the PWS category, or strata. Each PWS category is defined by a set of system characteristics including: the system type (community water system (CWS) and non-transient non-community water system (NTNCWS)), primary water source (ground or surface), and size category (nine categories). For each PWS category, the model calculates summary statistics that describe the costs (and benefits) associated with final LCRI compliance. These summary statistics include total costs and benefits, total costs per final regulatory requirement, total benefits per final regulatory requirement, the variability in PWS-level costs (*i.e.*, 10th, 25th, 75th, and 90th percentile system costs), and the variability in household-level costs. For additional information on the data sources used in the estimation of costs see Chapter 3 and Chapter 4, Sections 4.2.2, 4.3, 4.4, and 4.5. Also see Chapter 1, Exhibit 1-2 for the names and descriptions of the reports and spreadsheet files that support the estimation of costs which are available in the rulemaking docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

4.2.2 Modeling Uncertainty in the SafeWater LCR Model

This treatment technique rulemaking, and therefore the SafeWater LCR model, is complex, incorporating multiple compliance triggers (*e.g.*, AL exceedance (ALE), single sample exceedance, multiple ALEs) that require multiple and varying compliance actions (CCT installation or re-optimization, distribution system and site assessment, public education, temporary filter distribution) requiring a large number of inputs for the estimation of total compliance costs. Many of these inputs, which are specific to the assessment of the cost impacts of the final LCRI, are uncertain.

The EPA described in Chapter 3, Exhibit 3-78, the uncertainties in the baseline and compliance characteristics of public water systems that impact the estimation of both costs and/or benefits of the final LCRI. In addition to these baseline and system characteristics, there are additional uncertainties associated with estimating the costs of the final rule. These are listed in Exhibit 4-2.

Exhibit 4-2: Summary of Uncertainties in the Estimation of Compliance Actions and Costs

Source of Uncertainty	Section Discussed	Included in High/Low Scenarios	Potential Direction of Bias
SLR unit costs	4.3.4	Yes	Unclear[1]
Baseline pH levels at PWSs with or without existing CCT	4.3.3	No	Unclear[2]
Baseline Orthophosphate levels at PWSs with existing CCT installed	4.3.3	No	Unclear[2]
CCT capital and O&M unit costs	4.3.3	Yes	Unclear[2]
POU unit costs	4.3.5	No	Unclear[2]
PWS administrative activity unit costs	4.3.1	No	Unclear[3]
Sampling unit costs	4.3.2	No	Unclear[3]
Public education unit costs	4.3.6	No	Unclear[2]
State administrative unit costs	4.4	No	Unclear[3]
Wastewater treatment plant phosphorus treatment costs	4.5	No	Unclear[2]

Acronyms: CCT = corrosion control treatment; O&M = operations and maintenance; POU = point-of-use; PWS = public water system; SLR = service line replacement.
Note: [1] The EPA received public comments on the proposed rule unit cost for SLR indicating that the EPA's estimated unit costs for SLR where to low biasing modeled total cost downward, however the data provided by commenters was insufficient to allow EPA to re-estimate SLR unit cost or evaluate the directional bias claims. For additional information on the EPA's estimated SLR unit costs and comparisons to commenter provided data see Appendix A.
[2] The EPA did not receive sufficient specific data on the estimated unit cost or baseline characteristic that would allow the EPA to either re-estimates the cost or characteristic for the final rule or discern a potential direction of bias that may exist in the EPA values.
[3] The EPA received unit cost information through the proposed rule public comment process from the Association of State Drinking Water Administrators that allowed the EPA to re-estimates administrative costs for States and PWSs upward. The new cost information can be characterized as being more certain, but some degree of uncertainty still exists, and the direction of bias is unclear. See Chapter 4, Sections 4.3 and 4.4for additional information of the adjusted unit cost values.

The EPA determined it does not have enough information to perform a probabilistic uncertainty analysis as part of the SafeWater LCR model analysis for this rule. Instead, to capture uncertainty, the EPA estimated compliance costs (and benefits) using the SafeWater LCR model under low and high bracketing scenarios that capture the three most significant cost drivers (the first is a PWS baseline characteristic and the other two are compliance activity unit cost):

1. Likelihood a model PWS will exceed the AL and/or TL under the 2021 LCRR and the AL under the final LCRI[89]

[89] Exceedance of the AL and/or TL under the 2021 LCRR and the AL under the proposed LCRI will result in systems making changes to CCT, implementing public education, and potentially using point-of-use (POU) filters. This drives both costs and benefits in a consistent manner.

2. SLR unit costs
3. CCT capital and operations & maintenance (O&M) unit costs

Descriptions of these uncertain cost variables and the derivation of their values under the low and high scenarios follows in Sections 4.2.2.1, 4.2.2.2, and 4.2.2.3.

The low and high benefits bracketing scenarios are further defined by the following benefits variables:

1. Likelihood a model PWS will exceed the AL and/or TL under the 2021 LCRR and the AL under the final LCRI (the same variable used to define the low and high scenarios in the cost analysis).[90]
2. The concentration-response functions that characterize how reductions in blood lead levels (caused by changes in lead exposure) translate into avoided IQ reductions, cases of ADHD, and cardiovascular disease premature mortality.

See Chapter 5 for additional information on the selection of the concentration-response functions for the low and high scenarios in the benefits analysis.

4.2.2.1 Percent of Model PWSs that are Expected to Fall within Five Compliance Tap Sample 90th Percentile Categories

As described in Chapter 3, Section 3.3.5.1, the likelihood that a model PWS would have an initial lead 90th percentile value (P90) greater than or equal to the AL is based on SDWIS/Fed historical 90th percentile lead data from 2012 to 2020. The EPA recognizes that there are uncertainties in predicting the future 90th percentile values from historical SDWIS data. Also, the agency recognizes that these uncertainties could have a significant impact on estimated costs and benefits of the final LCRI. Therefore, the EPA developed two sets of expected percentages for placement of model PWSs into one of the five possible 90th percentile ranges (note that the subcategories of 90th percentile levels are used to estimate costs associated with options presented in Chapter 8). Because the implementation of a number of final rule requirements is driven by ALEs, the greater the estimated percent of systems above those levels, the greater the total final rule costs. Therefore, the low cost scenario uses data derived from the average 90th percentile value each PWS reported in SDWIS/Fed between 2012 to 2020. The data used in the high cost scenario is derived by using the highest 90th percentile value each PWS reported in SDWIS/Fed between 2012 to 2020. Exhibit 4-3 provides the likelihood that a model PWS, with or without LSLs, would be assigned a 90th percentile in each of the 90th percentile-ranges by the SafeWater LCR model under the 2021 LCRR in the low- and high-cost scenarios.

[90] Note, the estimated P90 values used to determine AL and/or TL exceedances are not directly used in the model to estimate lead exposure. See Chapter 5, Section 5.2 for detail on the tap water lead concentration sample data used in the estimation of exposure changes.

Exhibit 4-3: Likelihood of Initial Model PWS 90th Percentile Placement under the 2021 LCRR

Category	No LSLs	Has LSLs
Low Estimate		
≤ 5 µg/L	88.5%	55.5%
>5 and ≤10 µg/L	7.1%	24.5%
10 µg/L < P90 ≤ 12 µg/L	1.0%	5.3%
12 µg/L < P90 ≤ 15 µg/L	1.0%	5.2%
P90 > 15 µg/L	2.3%	9.6%
High Estimate		
≤ 5 µg/L	79.6%	37.8%
>5 and ≤10 µg/L	11.7%	25.4%
10 µg/L < P90 ≤ 12 µg/L	2.0%	6.8%
12 µg/L < P90 ≤ 15 µg/L	1.9%	6.0%
P90 > 15 µg/L	4.8%	24.1%

Acronyms: LCRR = Lead and Copper Rule Revisions; LSL = lead service line; P90 = lead 90th percentile level; PWS = public water system.
Note: Totals may not add due to independent rounding.

As discussed in Chapter 3, Section 3.3.5.1, under the final LCRI, the EPA estimated the percent of CWSs that would be assigned to one of five bins using historical SDWIS/Fed 90th percentile tap sample and applied the same following adjustments as was done for the 2021 LCRR. However, under the final LCRI, the AL has been lowered to 10 µg/L as opposed to 15 µg/L. Additional updates include:

1. An adjustment to reflect the new requirement for LSL systems to collect all samples from LSL sites where possible, as opposed to the previous LCR minimum of 50 percent of samples being collected from LSL sites.
2. An adjustment to reflect new requirements for LSL systems to collect both first- and fifth-liter samples from LSL sites instead of just first-liter samples (as required under the pre-2021 LCR) or just fifth-liter samples (as required under the 2021 LCRR) and to use the higher of the first- and fifth-liter sample in the 90th percentile calculation.[91]

Exhibit 4-4 provides the likelihood a model PWS, with or without LSLs, would be assigned a 90th percentile in each of the 90th percentile ranges by the SafeWater LCR model under the final rule in the low and high cost scenarios. Shaded (summary) rows are associated with the final rule requirement.

[91] In addition to this requirement, under the final LCRI, water systems must use the highest sample values in their 90th percentile calculation. These high samples could be from non-lead service line sites. The second adjustment does not explicitly model the impact of this rule requirement. The EPA uses a low and high adjustment to reflect the majority of the uncertainty of the new rule requirements on 90th percentile tap results. However, the possibility of using high non-lead service line samples in the calculation of the system's 90th percentile which is not captured in EPA's adjustment to historical 90th percentile information may result in an underestimate of ALEs in the analysis of the final rule.

Exhibit 4-4: Percent of CWSs by Lead 90th Percentile Classification under the Final LCRI

Category	No LSLs	Has LSLs
Low Estimate		
No ALE (P90 ≤10 µg/L)	**95.6%**	**79.0%**
≤ 5 µg/L	88.5%	54.4%
>5 and ≤10 µg/L	7.1%	24.6%
ALE (P90 >10 µg/L)	**4.4%**	**21.0%**
10 µg/L < P90 ≤ 12 µg/L	1.0%	5.2%
12 µg/L < P90 ≤ 15 µg/L	1.0%	5.6%
P90 > 15 µg/L	2.3%	10.3%
High Estimate		
No ALE (P90 ≤10 µg/L)	**91.3%**	**61.1%**
≤ 5 µg/L	79.6%	37.3%
>5 and ≤10 µg/L	11.7%	23.8%
ALE (P90 >10 µg/L)	**8.7%**	**38.9%**
10 µg/L < P90 ≤ 12 µg/L	2.0%	7.8%
12 µg/L < P90 ≤ 15 µg/L	1.9%	6.0%
P90 > 15 µg/L	4.8%	25.0%

Acronyms: ALE = action level exceedance; CWS = community water system; LCRI = Lead and Copper Rule Improvements; LSL = lead service line; P90 = lead 90th percentile level.
Source: "Initial P90 Categorization_5 bins_LCRI_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.
Note: Systems without LSLs can have lead sources that can contribute lead to drinking water such as premise plumbing with lead solder and brass or chrome-plated brass faucets.

4.2.2.2 SLR Unit Costs

SLR cost estimates are based on the EPA's review of submitted and completed LSLR projects reported in the 7th Drinking Water Infrastructure Needs Survey and Assessment (DWINSA) (USEPA, 2023a). For the LCRI, the EPA reviewed SLR projects with independent documentation of their estimated costs and a reported number of replaced service lines. Projects with unusually low-cost estimates (less than $700 per line), projects that included other non-lead SLR activities, and projects in which it was unclear whether the replacement was partial or full were excluded from the dataset. The final dataset included 33 LSLR projects across 31 water systems in 13 States with populations serving from 3,000 to over 2,000,000. Low and high SLR cost estimates are based on the 25th and 75th percentile data from 33 DWINSA reported projects. The EPA recognizes uncertainty in SLR unit costs by having a low- and high-cost estimate that are used in the low and high costing scenario, respectively. The detailed methodology for identifying qualified projects and estimating the LSLR costs is provided in Appendix A, Section A.2. Section A.3 of the appendix compares the SLR data from DWINSA to other data sources, including new data sources provided since the proposed LCRI, and provides a discussion of geographic representativeness.

The low and high estimates used in this economic analysis (EA) are presented in Exhibit 4-5. They provide a range of national costs for the final LCRI that reflects the degree of uncertainty in the average SLR unit costs. The EPA did not use the minimum and maximum values, from the 33 DWINSA reported projects, for this bounding exercise given that the characteristics of the projects associated with the minimum and maximum values are not representative of the majority of SLR projects nationally. The EPA selected the interquartile range (25th to 75th percentile range) to represent uncertainty in the mean SLR cost value because it is less sensitive to extreme values.[92] Using minimum and maximum values would have produced a national estimate range greater than what is warranted given the uncertainty in the distribution of SLR unit costs.

Exhibit 4-5: Summary of SLR Costs from DWINSA Survey ($/SLR, 2020$)

Statistic	SLR Unit Costs	
	Full	Partial
Number of Cost Estimates	23	10
Min	$1,180	$1,677
25th percentile value	**$6,507**	**$1,920**
Median	$7,232	$3,273
Mean	$6,930	$3,803
75th percentile value	**$8,519**	**$5,400**
Max	$14,966	$8,099

Acronyms: DWINSA = Drinking Water Infrastructure Needs Survey and Assessment; SLR = service line replacement.
Source: "LSLR Unit Costs_Final.xlsx," worksheet "DWINSA Data Analysis."
Notes: Data in this exhibit replicated data provided in Appendix A, Exhibit A-1.

The unit cost estimates used in the SafeWater LCR model do not include certain indirect and non-market costs which occur during service line replacement such as traffic congestion costs, inconvenience to homeowners and neighbors at SLR sites, potential short-term impact to the aesthetic appeal of the property, and additional impacts to landscaping and cost of replacement beyond lawn repair, which is included in the unit cost estimates above. See Chapter 6, Section 6.1.2for discussion of how EPA considered these non-quantified costs in its decision making.

4.2.2.3 CCT Unit Costs

The EPA developed the cost estimates for CCT scenarios using outputs from the caustic feed and phosphate feed Work Breakdown Structure (WBS) models (see *Technologies and Costs for Corrosion*

[92] Note commenters on the proposed LCRI and industry experts support the use of values other than the maximum for estimating national costs. CDM Smith (2022) stated that "The minimum and maximum costs for each item are the extremes and should not be used for estimating cost except under special circumstances with specific criteria for replacements." In their public comments on the proposed LCRI, Betanzo and Speight (2024) concluded that "The findings of this analysis show that very high FLSLR costs are real but outliers occur in very limited circumstances. The majority of FLSLR (full lead service line replacement) costs are substantially lower than the maximum and reliably below $10,000."

Control to Reduce Lead in Drinking Water (USEPA, 2023b)). Outputs from these models are point estimates of total capital and operation and maintenance (O&M) costs that correspond to a given set of inputs that include treatment plant design flow (DF) and average flow in million gallons per day (MGD). To estimate costs for CCT, the EPA fit cost curves to the WBS outputs for up to 49 different flow rates. Specifically, for each scenario modeled and separately for total capital and for O&M costs, the EPA fit three curves: one covering small systems (less than 1 MGD DF), one covering medium systems (1 MGD to less than 10 MGD DF), and one covering large systems (10 MGD DF and greater).

For each CCT scenario modeled, the EPA also estimated separate equations for low, mid, and high costs (see *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b)). The EPA developed the low, mid, and high cost equations by varying the component level input in the WBS models. This input drives the selection of materials for items of equipment that can be constructed of different materials. For example, a low cost system might include fiberglass storage tanks and polyvinyl chloride (PVC) piping. A high cost system might include stainless steel storage tanks and stainless steel piping. The component level input also drives other WBS model assumptions that can affect the total cost, such as building quality and heating and cooling. Because of uncertainty in the component level materials selection a PWSs would choose for real world installation or re-optimization of CCT technology, the EPA chose to use the low CCT cost equations in the SafeWater LCR model for the low cost scenario and, for the high cost scenario, the SafeWater LCR model uses the high CCT cost equations.

4.2.3 Model PWSs, Very Large Systems, Discounting and Cost of Capital, Compliance Schedule, and Simulating Compliance Activities

4.2.3.1 Model Public Water Systems

As discussed above in Sections 4.2.1 and 4.2.2, under the regulatory provisions of the final LCRI, PWSs will face different compliance scenarios depending on the size, the type of water system, the presence of LSLs, and existing corrosion controls. In addition, PWSs will also face different unit costs based on water system size, type, and number of entry points (*e.g.*, labor rates and CCT capital, and O&M unit costs). PWSs have a great deal of inherent variability across the water system characteristics that dictate both compliance activities and cost.

Because of this variability, to accurately estimate the national level compliance costs (and benefits) of the final LCRI, as well as describe how compliance costs are expected to vary across types of PWSs, the SafeWater LCR model creates a sample of representative “model PWSs” by combining the PWS-specific data available in SDWIS/Fed with data on baseline and compliance characteristics available at the PWS category level. The SafeWater LCR model follows each model PWS in the sample through each year of analysis – determining how the PWS will comply with each requirement of the final rule, estimating the yearly compliance cost, and tracking the impact of the compliance actions on drinking water lead concentrations. It also tracks how other events, such as changing a water source or treatment, affect the water system’s compliance requirements for the next year.

In constructing the initial model PWS sample for the cost-benefit analysis, the EPA began with the 49,529 CWSs and 17,418 NTNCWSs in SDWIS/Fed. Also, from SDWIS/Fed, the EPA knows each water system’s type (CWS or NTNCWS); primary water source (surface water or groundwater); population

served; CCT status (yes/no); ownership (public or private); and number of connections. Because some PWS baseline characteristics are being assigned from distributional source data to capture the variability across PWS characteristics, the EPA needed to ensure that its sample size was large enough that the results of the cost-benefit model were stable for each of the 72 PWS categories. To ensure stability in modeled results, the EPA oversampled the SDWIS/Fed inventory to increase the number of water systems in each PWS category. For every PWS category, the EPA set the target minimum number of model-PWSs to 5,000. To calculate the total estimated costs for each PWS category, the SafeWater LCR model weights the estimated per water system costs so that, when summed, the total cost is appropriate for the actual number of water systems known to be in the category. See Appendix B Section B.2 for more detail.

With the exception of the three uncertain variables, which define the difference between the low and high cost scenarios, the remaining baseline water system and compliance characteristics are assigned to model PWSs, as described in Section 4.2.2 above and Appendix B, Section B.2, and remain constant across the scenarios. This allows the EPA to define the uncertainty characterized in the cost range provided by the low and high scenarios and maintain consistency between the estimation of costs for the 2021 LCRR and final LCRI (*e.g.*, number of systems with lead content service lines and percent of connections that are lead content service lines).

4.2.3.2 Very Large Systems

The exception to the assignment of water system characteristics discussed in Sections 4.2.1, and Appendix B.2.3 are the 24 very large water systems serving more than one million people. Because of the small number of water systems in this size category, the uniqueness of their system characteristics, and the potential large cost for these systems to comply with the final regulatory requirements, using the methods described above to assign system attributes could result in substantial error in the estimation of the national costs. Therefore, the EPA attempted to collect information on very large water systems' CCT practices and chemical doses, pH measurements and pH adjustment practices, number of lead and GRR service lines, service populations, and average annual flow rates for each entry point to the distribution system. The EPA gathered this information from publicly available data such as SDWIS/Fed facility-level data, Consumer Confidence Reports (CCR), and water system websites.[93] In addition, the American Water Works Association (AWWA) provided additional data from member water systems to fill in gaps.[94] When facility-specific data was available, the EPA used it to estimate compliance costs for the very large water systems. If data were not available, the EPA assigned baseline characteristics using the same process as previously described. See Appendix B, Section B.2.3 for a summary of the data the EPA collected on these very large systems.

4.2.3.3 Discounting and Cost of Capital

The SafeWater LCR model estimates the incremental cost of the final LCRI over a 35-year period. In accordance with the EPA's policy, and based on the current guidance from OMB, when calculating social costs and benefits, the EPA discounted future costs (and benefits) at a 2 percent discount rate.

[93] See "VLSEntryPointValues.xlsx" and "VLSSystemData.xlsx" for the information gathered on VLSs and used in SafeWater LCR.
[94] AWWA, personal communication, December 31, 2017, and March 5, 2018.

When evaluating the economic impacts on PWSs and households, the EPA uses the estimated PWS cost of capital to discount future costs, as this best represents the actual costs of compliance that water systems would incur over time. The EPA used data from the 2006 Community Water System Survey (CWSS) to estimate the PWS cost of capital (USEPA, 2009). The EPA calculated the overall weighted average cost of capital (across all funding sources and loan periods) for each size/ownership category, weighted by the percentage of funding from each source. The cost of capital for each CWS size category and ownership type is shown in Exhibit B-3 in Appendix B.2.4. Since similar cost of capital information is not available for NTNCWSs, the EPA used the CWS cost of capital when calculating the annualized cost per NTNCWS. Total estimated cost of capital may be greater than actual costs water systems bear when complying with future regulatory revisions because financing support for lead reduction efforts may be available from State and local governments, the EPA programs (*e.g.*, the Bipartisan Infrastructure Act and other federal funding administered through the DWSRF, the Water Infrastructure Finance and Innovations Act (WIFIA) Program, and the WIIN Act grant programs), and other federal agencies (e.g., the United States Department of Housing and Urban Development's (HUD's) Community Development Block Grants). Also see Section IV.G of the final LCRI Federal Register Notice (FRN) for a list of potential funding sources. The availability of funds from government sources, while potentially reducing the cost to individual PWSs, does not reduce the social cost of capital to society.

4.2.3.4 Schedule

The EPA projects that rule implementation activities will begin immediately after rule promulgation. These activities will include one-time PWS and State costs for staff to read the rule, become familiar with its provisions, and develop training materials and train employees on the new rule. States will also incur burden hours associated with adopting the rule into State requirements, updating their LCR program policies and practices, modifying data record keeping systems, conferring with systems on initial planning for SLRs, reviewing inventory updates, and assisting and reviewing public education material associated with service lines with lead or unknown content. PWSs will incur costs to comply with the service line inventory requirements; develop an initial SLR plan if the system has one or more known lead, GRR, or unknown service lines, and develop and distribute public education material associated with service lines that are classified in the inventory as lead, GRR, or unknown material in Years 1 through 3 of the analysis.[95] The EPA expects that water systems will begin complying with all other final rule requirements three years after promulgation, or in Year 4 of the analysis.

4.2.3.5 Simulating Compliance Activities

Some requirements of the final rule must be implemented by water systems regardless of their water quality and tap sampling results (*e.g.*, service line material inventory updates, mandatory SLR, and CWS school and child care facility sampling programs). However, other activities are a function of a water system's 90th percentile lead tap sample value.[96] Because a water system's lead 90th percentile value is

[95] For additional information on unit cost by system size for activities associated with developing and updating the service line inventory, developing the initial SLR plan, and developing and distributing inventory-related outreach material, see Sections 4.3.4.1, 4.3.4.2, and 4.3.6.2, respectively.

[96] Distribution system and site assessment adjustments to CCT are required for a single lead tap sample exceedances of the AL. This requirement was previously referred to as "find-and-fix" under the 2021 LCRR. The provision of temporary pitcher filters are triggered by multiple ALE violations. Both of these compliance requirements are also positively associated with system level 90th percentile tap sample values.

so important to determining regulatory requirements and cost under the final LCRI, the SafeWater LCR model tracks each model PWS's 90th percentile value over each annual time step in the model. The 90th percentile value, and if it exceeds the lead AL, dictates:

- the tap water sampling and WQP monitoring schedules,
- the installation/re-optimization of CCT,
- the installation of point-of-use (POU) filters at water systems selecting this treatment option as part of the small water system flexibilities of the final LCRI, and
- public education and public notification requirements.

Under the final LCRI, the SafeWater LCR model assumes a PWS's 90th percentile tap sample values will drop below the ALE once they (1) install or re-optimize CCT; (2) install POU or (3) removes all SLs with lead content.[97] When the PWS no longer has a 90th percentile tap sample value above the AL, it incurs lower sampling, public education, and notification costs.

The SafeWater LCR model allows for future increases in 90th percentile values because of changes in source water or treatment. The likelihood of these events occurring has been derived from SDWIS/Fed data (see Chapter 3). When a change in source or treatment occurs in a modeled year, a new 90th percentile value is assigned to the water system. This value may be higher or lower than the current value thus potentially triggering new corrective actions. In the SafeWater LCR model, if a water system already has "optimized" CCT or POU in place, it is assumed that no additional action is needed and that the current treatment is adequate; therefore, the 90th percentile will not change.

4.3 Estimating Public Water System Costs

This section details how the EPA estimated the cost of water system compliance for each major rule component of the final LCRI, including:

- 4.3.1: PWS Implementation and Administrative Costs
- 4.3.2: PWS Sampling Costs
- 4.3.3: PWS Corrosion Control Costs
- 4.3.4: PWS Service Line Inventory and Replacement Costs
- 4.3.5: PWS POU-Related Costs
- 4.3.6: PWS Lead Public Education, Outreach, and Notification Costs

Section 4.3.7 provides a summary of PWS costs including PWSs counts and population affected by each major requirement, as well as costs by system and source water type and size category for low and high cost scenarios using a 2 percent discount rate. In addition, the cost per household is also presented.

[97] In Chapter 8, the EPA has analyzed the costs and benefits of an alternative option that includes an AL of 5 µg/L. Under this AL, the EPA assumes that 10 percent of PWSs with service lines with lead content, and 3 percent of PWSs with no SLs with lead content, will not be able to achieve the AL.

For most activities, water systems will incur costs in the form of burden (*i.e.,* hours). The burden is multiplied by the labor rate ($/hr), as presented in Chapter 3, Section 3.3.11.1, to estimate labor unit costs. Systems will also incur capital and O&M costs for some activities. Exhibit 4-6 provides an overview of the rule components, subcomponents, and activities for which the EPA estimates water system costs for the final LCRI. The derivation of unit burden and/or cost is provided in each referenced subsection.

At the end of each subsection, the EPA provides a summary exhibit showing the SafeWater LCR modeling approach for each water system activity (*e.g.*, Exhibit 4-8, Exhibit 4-16). The exhibits are organized as follows:

- The first and second columns show how unit burden and labor rate information is combined to estimate a CWS and NTNCWS cost per activity, respectively.
- The third and fourth columns indicate the conditions under which the water system activity occurs. The columns indicate if the system activity is dependent on:
    - The system's 90th percentile range. See Appendix B, Section B.2 for a detailed discussion of how the SafeWater LCR model tracks a water system's 90th percentile level and accounts for changes in the 90th percentile level over the 35-year analysis period.
    - Other characteristics of the system such as presence or absence of LSL/GRR service lines and/or CCT, and frequency of monitoring.
- The fifth column indicates the frequency of the activity (*e.g.*, one-time, annually, every 3 years).

The SafeWater LCR model uses the information from these exhibits to calculate total annualized water system cost for each activity. See Section 4.2 for detail on the cost modeling methodology.

As noted in Section 4.1, costs for model water systems presented in this section are ***LCRI costs if no previous rule was in place***. The national costs of the LCRI, or incremental costs, are the difference between the cost of compliance with the LCRI and the cost of compliance with the 2021 LCRR. These incremental national costs are presented in Section 4.1.[98]

For the purpose of the SafeWater LCR modeling, all cost model inputs are assigned a unique data variable name, usually in the form of abbreviations, or shorthand, separated by underlined spaces (*e.g., rate_op, hrs_read_rule_op*). The SafeWater LCR model uses these data variables to model LCRI scenarios for different system sizes and types.

Exhibit 4-6: PWS Cost Components, Subcomponents, and Activities Organized by Section[1]

Component	Subcomponents	Activities[2]
4.3.1: PWS Implementation and Administrative Costs	4.3.1.1: PWS One-Time Implementation and Administrative Costs	a) Read and understand the rule. b) Assign personnel and resources for rule implementation. c) Participate in training and technical assistance provided by the State during rule implementation.

[98] Incremental national costs for the final LCRI using the pre-2021 LCR as the baseline for comparison are available in Appendix C, Section C.2.

Component	Subcomponents	Activities[2]
		d) Provide small system flexibility option recommendation to the State.
4.3.2: PWS Sampling Costs	4.3.2.1: PWS Lead Tap Sampling	a) Update sampling instructions for lead tap sampling and submit to the State. b) Contact homes to establish new 100 percent LSL tap sampling pool. c) Update and submit tap sampling plan to the State. d) Report any changes in sampling locations to the State. e) Confer with the State on initial lead sampling data and status under the LCRI. f) Obtain households for each round of lead tap sampling. g) Offer incentives to households to encourage participation in lead tap sampling program. h) Ship tap sampling material and instructions to participating households. i) Collect lead tap samples. j) Determine if a sample should be rejected and not analyzed. k) Analyze lead tap samples in-house or commercially. l) Prepare and submit sample invalidation request to the State. m) Inform consumers of tap sample results. n) Certify to the State that results were reported to consumers. o) Submit request to renew 9-year monitoring waiver to the State. p) Submit sampling results and 90th percentile calculation to the State. q) Oversee the customer-initiated lead sampling program. r) Ship tap sampling material and instructions to participating households for customer-initiated lead sampling program. s) Collect lead tap samples for customer-initiated lead sampling program. t) Analyze lead tap samples in-house or commercially for customer-initiated lead sampling program. u) Inform customers of lead tap sample results for customer-initiated lead sampling program.
	4.3.2.2: PWS Lead Water Quality Parameter Monitoring	v) Collect lead WQP samples from the distribution system. w) Analyze lead WQP samples from the distribution system. x) Collect lead WQP samples from entry points. y) Analyze lead WQP samples from entry points. z) Report lead WQP sampling data and compliance with OWQPs to the State.
4.3.2: PWS Sampling Costs (Continued)	4.3.2.3: PWS Copper Water Quality Parameter Monitoring	aa) Collect copper WQP samples from the distribution system. bb) Analyze copper WQP samples from the distribution system. cc) Collect copper WQP samples from entry points.

Component	Subcomponents	Activities[2]
		dd) Analyze copper WQP samples from entry points. ee) Report copper WQP sampling data and compliance with OWQPs to the State.
	4.3.2.4: PWS Source Water Monitoring	ff) Collect source water samples. gg) Analyze source water samples. hh) Report source water monitoring results to the State.
	4.3.2.5.1: CWS School and Child Care Facility Lead Sampling Costs – First Five-Year Cycle	ii) Create a list of schools and child care facilities served by CWS and submit to State. jj) Develop lead outreach materials for schools and child care facilities. kk) Prepare and distribute initial letters explaining the sampling program and the EPA's 3Ts Toolkit. ll) Contact elementary school or child care facility to determine and finalize its sampling schedule (one-time) or contact secondary school to offer sampling (annual). mm) Contact school or child care facility to coordinate sample collection logistics. nn) Conduct walkthrough at school or child care facility before the start of sampling. oo) Travel to collect samples. pp) Collect samples. qq) Analyze samples. rr) Provide sampling results to tested facilities. ss) Discuss sampling results with the school or child care facility. tt) Conduct detailed discussion of high sampling results with schools and child care facilities. uu) Report school and child care facility sampling results to the State. vv) Prepare and provide annual report on school and child care facility sampling program to the State.
	4.3.2.5.2: CWS School and Child Care Facility Lead Sampling Costs – Second Five-Year Cycle On	ww) Update the list of schools and child care facilities and submit to the State. xx) Contact schools and child care facilities to offer sampling. yy) Contact the school or child care facility to coordinate sample collection logistics. zz) Conduct walkthrough at school or child care facility before the start of sampling. aaa) Travel to collect samples. bbb) Collect samples. ccc) Analyze samples. ddd) Provide sampling results to tested facilities. eee) Discuss sampling results with the school and child care facility.

Component	Subcomponents	Activities[2]
		fff) Conduct detailed discussion of high sampling results with schools and child care facilities. ggg) Report school and child care facility sampling results to the State. hhh) Prepare and provide annual report on school and child care facility sampling program to the State.
4.3.3: PWS Corrosion Control Costs	4.3.3.1: CCT Installation	a) Conduct a CCT study. b) Install CCT (PO_4, PO_4 with post treatment, pH adjustment, or modify pH).
	4.3.3.2: Re-optimization of Existing Corrosion Control Treatment	c) Revise CCT study. d) Re-optimize existing CCT.
	4.3.3.3: DSSA Costs	e) Contact customers and collect follow-up tap sample. f) Analyze follow-up lead tap sample. g) Collect distribution system WQP sample. h) Analyze distribution system WQP sample. i) Review incidents of systemwide events and other system conditions. j) Consult with the State prior to making CCT changes. k) Report follow-up sample results and overall DSSA responses to the State.
	4.3.3.4: System Lead CCT Routine Costs	l) Review CCT guidance. m) Provide WQP data to the State and discuss during sanitary survey. n) Notify and consult with the State on required actions in response to source water change. o) Notify and consult with the State on required actions in response to treatment change.
4.3.4: PWS Service Line Inventory and Replacement Costs	4.3.4.1: Service Line Inventory	a) Conduct records review for connector materials. b) Compile and submit connector updated LCRR initial inventory information (baseline inventory) to the State. c) Identify material for unknown service lines. d) Report annual inventory updates to the State. e) Conduct field investigations for inventory validation. f) Report validation results to the State.
	4.3.4.2: Service Line Replacement Plan	g) Develop initial SLR plan and submit to the State for review. h) Identify funding options for full SLRs. i) Include information on deferred deadline and associated replacement rate in the SLR plan. j) Update SLR plan annually or certify no changes. k) Provide an updated recommendation of the deferred deadline and associated replacement rate.
	4.3.4.3: Physical Service Line Replacements	l) Systems replace lead and GRR service lines.
	4.3.4.4: Ancillary Service Line Replacement Activities	m) Contact customers and conduct site visits prior to service line replacement.

Component	Subcomponents	Activities[2]
		n) Deliver filters and 6 months of replacement cartridges at time of service line replacement. o) Collect tap sample post-service line replacement. p) Analyze post-service line replacement tap sample. q) Inform customers of tap sample result. r) Submit annual report on service line replacement program to the State.
4.3.5: PWS POU-Related Costs (Small System Compliance Option)	4.3.5.1: POU Device Installation and Maintenance	a) Provide, monitor, and maintain POU devices.
	4.3.5.2: POU Ancillary Activities	b) Develop POU plan and submit to the State. c) Develop public education materials and submit to the State. d) Print POU education materials. e) Obtain households for POU monitoring . f) Deliver POU monitoring materials and instructions to participating households. g) Collect tap samples after POU installation. h) Determine if sample should be rejected and not analyzed. i) Analyze POU tap samples. j) Prepare and submit sample invalidation request to the State. k) Inform customers of POU tap sample results. l) Certify to the State that POU tap results were reported to customers. m) Prepare and submit annual report on POU program to the State.
4.3.6: PWS Lead Public Education, Outreach, and Notification Costs	4.3.6.1: Consumer Notice	a) Develop lead consumer notice materials and submit to the State for review. b) Provide a copy of the consumer notice and certification to the State.
	4.3.6.2: Activities Regardless of Lead 90th Percentile Level	c) Update CCR language. d) Develop new customer outreach plan. e) Develop approach for improved public access to lead health-related information and tap sample results. f) Establish a process for public access to information on known or potential lead content SL locations and tap sample results. g) Maintain a process for public access to lead health information, known or potential lead content SL locations, and tap sample results. h) Respond to customer request for known or potential lead content SL information. i) Respond to requests from realtors, home inspectors, and potential home buyers for known or potential lead content SL information. j) Develop a list of local and State health agencies. k) Develop lead outreach materials for local and State health agencies and submit to the State for review.

Component	Subcomponents	Activities[2]
		l) Deliver lead outreach materials for local and State health agencies. m) Develop public education materials for known or potential lead content SL disturbances and submit to the State. n) Deliver public education for SL disturbances. o) Deliver filters and 6 months of replacement cartridges during disturbances of service lines. p) Develop inventory-related outreach materials and submit to the State for review. q) Distribute inventory-related outreach materials. r) Provide translation services for public education materials. s) Certify to the State that lead outreach was completed.[3]
	4.3.6.3: Public Education Activities in Response to Lead ALE	t) Update mandatory language for lead ALE public education and submit to the State for review. u) Deliver lead ALE public education materials to all customers. v) Post notice to website. w) Prepare press release. x) Contact public health agencies to obtain additional organizations and update recipient list. y) Notify public health agencies and other organizations. z) Consult with State on other public education activities. aa) Implement other public education activities.
	4.3.6.4: Public Education Activities in Response to Multiple Lead ALEs	bb) Develop plan for making filters available and submit to the State for review. cc) Develop outreach materials for systems with multiple lead ALEs and submit to the State for review. dd) Conduct enhanced public education for systems with multiple lead ALEs. ee) Consult with State on filter program for systems with multiple lead ALEs. ff) Administer filter program for systems with multiple lead ALEs. gg) Make filters available due to multiple lead ALEs.

Acronyms: ALE = action level exceedance; CCR = consumer confidence report; CCT = corrosion control treatment; CWS = community water system; DSSA = Distribution System and Site Assessment; GRR = galvanized requiring replacement; LSL = lead service line; LSLR = lead service line replacement; OCCT = optimal corrosion control treatment; OWQPs = optimal water quality parameters; PO_4 = orthophosphate; POU = point-of-use; PWS = public water system; SL = service line; SLR = service line replacement; WQP = water quality parameter.

Notes:

[1] Systems will also incur burden for recordkeeping activities under the LCRI, such as retaining records of decisions, supporting documentation, technical basis for decisions, and documentation submitted by the system. The EPA has included burden for recordkeeping with each activity when applicable and opposed to providing separate burden estimates.

[2] The EPA assigned a unique letter identification (ID) for each activity under a given rule component. Activities are generally organized with upfront, one-time activities first followed by ongoing activities.

[3] This certification is inclusive of outreach activities in Sections 4.3.6.1 through 4.3.6.3.

4.3.1 PWS Implementation and Administrative Costs

PWSs will incur a one-time burden to implement the new requirements. These activities and associated SafeWater LCR model cost inputs are described in Section 4.3.1.1. Section 4.3.1.2 provides the estimated incremental annualized national PWS implementation and administrative costs for the LCRI at a 2 percent discount rate.

4.3.1.1 PWS One-Time Implementation and Administrative Costs

The EPA estimated that systems will incur a one-time burden to begin rule implementation. The EPA has identified and developed costs for four activities as shown in Exhibit 4-7. The exhibit provides the unit burden and/or cost estimate for each activity. The last column provides the data variable used in the SafeWater LCR cost model. The assumptions used in the estimation of each activity follow the exhibit. The EPA recognizes that systems would also incur administrative burden related to specific requirements under the final LCRI. In these cases, the system burden is estimated under that particular rule requirement.

Exhibit 4-7: PWS One-Time Administration Activities and Unit Burden Estimates

Activity	Unit Burden and/or Cost (hours/system)	***SafeWater LCR Data Variable***
a) Read and understand Rule	16 per PWS	*hrs_read_rule_op*
b) Assign personnel and resources for rule implementation	8 per PWS	*hrs_assign_staff_imp_op*
c) Participate in training and technical assistance provided by the State during rule implementation	8 per PWS	*hrs_initial_ta_op*
d) Provide small system flexibility option recommendation to the State	12 hrs/CWSs serving ≤3,300 and all NTNCWSs	*hrs_sm_flex_option_op*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system

Sources:

a), b): Based on implementation burden estimated for USEPA's 2012, *Economic Analysis for the Final Revised Total Coliform Rule* (USEPA, 2012a). Available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

c): Based on the EPA's 2015 *Public Water System Supervision Program Information Collection Request (Renewal)* (USEPA, 2015a). Available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

d): Association of State Drinking Water Administrators (ASDWA) 2024 Costs of States Transactions Study (CoSTS) model, section "Small System Flexibility" (ASDWA, 2024).

Note: These data variables are also provided in "Administrative Burden and Costs_Final.xlsx."

a) Read and understand the rule (hrs_read_rule_op). Based on previous experience with rule implementation, the EPA used the burden estimate of 4 hours from in the *Economic Analysis for the Final Revised Total Coliform Rule* (USEPA, 2012a) as a starting point and revised the value upward to account for the complexity of the regulatory requirements under the final LCRI. The EPA estimated that systems would require a total of 16 hours to read and understand the rule revisions.

b) ***Assign personnel and resources for rule implementation (hrs_assign_staff_imp_op).*** The EPA assumed systems would require an additional 8 hours to assign appropriate personnel and resources to carry out the new requirements under the final LCRI. This estimate is also consistent with estimates used in the *Economic Analysis for the Final Revised Total Coliform Rule* (USEPA, 2012a).

c) ***Participate in training and technical assistance provided by the State during rule implementation (hrs_initial_ta_op).*** The EPA assumed systems would require an additional 8 hours to attend training and receive other technical assistance from the State. This estimate is based on the data from the EPA's 2015 *Public Water System Supervision Program* Information Collection Request (ICR) (Renewal) (USEPA, 2015a).

d) ***Provide small System flexibility option to the State (hrs_sm_flex_option_op).*** CWSs serving 3,300 or fewer people and all NTNCWSs that exceed the revised AL of 10 µg/L must submit a recommended compliance option to their State to address lead. The EPA estimates each system will require 12 hours to develop and submit this recommendation, which is twice the burden estimated by the Association of State Drinking Water Administrators (ASDWA) in their 2024 Costs of States Transactions Study (CoSTS) model, hereafter referred to as the ASDWA 2024 CoSTS model (ASDWA, 2024) for States to review this plan (data variable, *hrs_sm_flex_option_js*).[99] See Section 4.4.1.1, activity e) for a discussion of the corresponding State input.

Exhibit 4-8 provides the SafeWater LCR model cost estimation approach for system one-time PWS administrative and rule implementation activities including additional cost inputs required to calculate these costs.

Exhibit 4-8: PWS Administration and Rule Implementation Cost Estimation in SafeWater LCR by Activity

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Read and understand the rule				
The total hours per system multiplied by the system labor rate. *(hrs_read_rule_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
b) Assign personnel and resources for rule implementation				

[99] For the proposed LCRI EA, the EPA assumed a burden of 10 hours for systems to develop and submit a small system flexibility option that was twice the burden needed for the States' review, based on ASDWA's 2020 CoSTS model (ASDWA, 2020b). The 2020 model estimated the increase in costs to States to implement the final 2021 LCRR requirements and was provided to the agency as part of the public comment process on the 2021 LCRR proposed rulemaking. The EPA subsequently revised its burden estimate for the final rule based on ASDWA's 2024 CoSTS model. ASDWA originally submitted the 2024 model as Appendix C to its public comments on the proposed LCRI and made slight modifications to a version submitted to the EPA on April 18, 2024. The ASDWA 2020 and 2024 CoSTS models are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The total hours per system multiplied by the system labor rate. *(hrs_assign_staff_imp_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
c) Participate in training and technical assistance provided by the State during rule implementation				
The total hours per system multiplied by the system labor rate. *(hrs_initial_ta_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
d) Provide small system flexibility lead compliance option to State				
The total hours per system multiplied by the system labor rate. *(hrs_sm_flex_option_op*rate_op)*	Cost applies as written to NTNCWSs.	Above AL	CWSs serving ≤ 3,300 people and NTNCWSs	One time

Acronyms: AL = action level; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Note: The data variables in the exhibit are defined previously in Section 4.3.1.1 with the exception of:

- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

4.3.1.2 Estimate of PWS National Implementation and Administrative Costs

As shown in Exhibit 4-1, the estimated monetized incremental annualized national PWS implementation and administrative costs for the final LCRI range from $3.3 million, under the low scenario, to $3.2 million, under the high scenario, at a 2 percent discount rate in 2022 dollars.

4.3.2 PWS Sampling Costs

This section provides system unit burden and cost for lead tap sampling, lead WQP monitoring, copper WQP monitoring, source water monitoring, and CWS sampling in schools and child care facilities in Sections 4.3.2.1 through 4.3.2.5, respectively. Incremental national annualized sampling costs are presented at a 2 percent discount rate in Section 4.3.2.6 in Exhibit 4-48.

4.3.2.1 PWS Lead Tap Sampling

The discussion of lead tap sampling costs for water systems is presented in three subsections as follows:

- 4.3.2.1.1: Lead Tap Sampling Schedules and Required Number of Samples
- 4.3.2.1.2: Lead Tap Sampling Activities
- 4.3.2.1.3: Lead Tap Sampling PWS Unit Cost Estimation Example

Exhibit 4-16 at the end of Section 4.3.2.1 is a summary exhibit that indicates how the cost inputs are modeled by the SafeWater LCR model. Note that the SafeWater LCR model does not include the costs of copper tap sampling. Because the final LCRI does not change the current regulatory requirements associated with copper tap sampling the incremental cost associated with these provisions under the final LCRI are equal to zero.

Activities and costs for tap monitoring associated with the POU program are not included in this section but are provided in Section 4.3.5.

4.3.2.1.1 Lead Tap Sampling Schedules and Required Number of Samples

All CWSs and NTNCWSs are subject to lead tap sampling requirements. The frequency and required number of samples depend on the systems' lead 90th percentile level. All systems with lead and GRR service lines are assumed to conduct one year of semi-annual monitoring at the start of LCRI compliance (assumed to be Year 4) with the exception of LSL systems in Michigan because they would have monitored according to the LCRI sampling protocol (*i.e.,* collect both a first- and fifth-liter lead sample) prior to the rule's compliance date. As a simplifying approach, the EPA modeled all water systems in Michigan as having all non-lead service lines.[100] Only systems with a 90th percentile level at or below the AL of 10 µg/L can qualify to conduct lead tap sampling annually at the standard number of sites or triennially at the reduced number of sites. Some systems may be granted waivers by their State to sample every 9 years, consistent with the LCR and 2021 LCRR. (Refer to Chapter 3, Section 3.3.7 for additional detail regarding reduced monitoring schedules and criteria). Those systems with lead ALEs must conduct lead tap sampling every six months at the standard number of sample sites (*i.e.*, standard semi-annual monitoring). In addition, systems must sample for a minimum of two, six-month tap sampling monitoring periods following a change in source water or significant or long-term change in treatment.

Because the number of required sampling sites and sampling schedules can vary, costs are estimated separately for systems on the different lead tap sampling monitoring schedules. All systems with lead and GRR service lines are assumed to conduct semi-annual monitoring in Year 4 to determine their 90th percentile lead level. After Year 4, the EPA estimated the percentages of systems with a 90th percentile level at or below 10 µg/L that would be on semi-annual monitoring,[101] and on a reduced annual *(p_tap_annual)*, triennial *(p_tap_triennial)*, or 9-year *(p_tap_nine)* monitoring schedule based on historical SDWIS/Fed data. Chapter 3, Section 3.3.7 provides a detailed discussion of how these percentages were derived. Exhibit 3-39 and Exhibit 3-40 provide the percentage of CWSs with 90th percentile levels of ≤ 10 µg/L with CCT and without CCT, respectively, on semi-annual monitoring and annual monitoring at the standard number of sites and triennially or every nine years at the reduced number of sites. Exhibit 3-41 and Exhibit 3-42 provide similar information for NTNCWSs with and without CCT, respectively.

[100] There is uncertainty in using this approach because Michigan did not require first- and fifth-liter samples for systems with GRR service lines and having no LSLs. For these systems, the burden and cost for lead tap monitoring may be underestimated.
[101] The likelihood that a system without lead or GRR service lines and with a 90th percentile value at or below 10 µg/L being on a semi-annual monitoring schedule is 1 minus (*p_tap_annual* + *p_tap_triennial* + *p_tap_nine*).

Exhibit 4-9 provides the minimum number of tap samples for CWSs and NTNCWSs on standard monitoring and reduced monitoring schedules. These requirements have not been modified under the final LCRI.

Exhibit 4-9: Minimum Number of Lead Tap Sampling Sites for Standard and Reduced Monitoring

System Size (Population Served)	Standard Monitoring	Reduced Monitoring
	Minimum Number of Tap Samples	
	numb_samp_customer	*numb_reduced_tap*
	A	B
≤100	5	5
101-500	10	5
501-3,300	20	10
3,301-10,000	40	20
10,001-100,000	60	30
>100,000	100	50

Source: Lead and Copper Rule, 40 CFR 141.86(c).
Notes: The final LCRI did not modify the minimum required number of lead tap samples.
A: The required number of sites for CWSs and NTNCWSs on standard monitoring schedules.
B: The required number of sites for CWSs and NTNCWSs on reduced monitoring schedules. Under the final LCRI, only systems with lead 90th percentile levels at or below 10 µg/L can qualify for reduced monitoring.

4.3.2.1.2 Lead Tap Sampling Activities

The EPA has developed costs for system activities associated with lead tap sampling as shown in Exhibit 4-10. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the State instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes. This section does not pertain to CWSs serving 3,300 or fewer people or NTNCWSs that are using the POU provision and maintenance program as their lead compliance option. These systems have some different lead tap sampling requirements that are discussed in Section 4.3.5.

Exhibit 4-10: PWS Lead Tap Sampling Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost[1]	*SafeWater LCR Data Variable*
a) Update sampling instruction for lead tap sampling and submit to the State (one-time)	2 hrs/CWS and NTNCWS	*hrs_devel_samp_op*[2]
b) Contact homes to establish new 100 percent LSL tap sampling pool (one-time)	5 to 100 hrs/CWS with LSLs	*hrs_add_lsl_samp_op*
c) Update and submit tap sampling plan to the State (one-time)	No LSLs: 2 to 6 hours per PWS With LSLs: 8 to 20 hours per PWS	*hrs_samp_plan_op*

Activity	Unit Burden and/or Cost[1]	*SafeWater LCR Data Variable*
d) Report any changes in sampling locations to the State	3 hrs/CWS	*hrs_chng_tap_op*
e) Confer with the State on initial lead sampling data and status under the LCRI (one-time)	2 hrs/PWS	*hrs_initial_tap_confer_op*
f) Obtain households for each round of lead tap sampling	<u>Burden per sample</u> (CWSs only) No LSLs: 0.5 hrs With LSLs: 1 hrs	*hrs_samp_volunt_op*
g) Offer incentives to households to encourage participation in lead tap sampling program	$10 to $100/sample per CWS	*cost_incentive*
h) Ship tap sampling material and instructions to participating households	<u>Burden per sample (CWSs only)</u> 0.25 hrs <u>Cost per sample (CWSs only)</u> No LSLs: $8.57 to $11.33 With LSLs: $8.96 to $23.21	<u>Burden</u> *hrs_discuss_samp_op* <u>Cost</u> *cost_5_lt_samp*[3]
i) Collect lead tap samples	<u>Burden per sample</u> 0.40 to 0.71 hrs per CWS; 0.5 hrs per NTNCWS <u>Cost per sample</u> $5.75 to $10.24 per CWS	<u>Burden</u> *hrs_pickup_samp_op* <u>Cost</u> *cost_pickup_samp*
j) Determine if a sample should be rejected and not analyzed	0.25 hrs/rejected sample for CWSs	*hrs_samp_reject_op*
k) Analyze lead tap samples in-house or commercially	<u>In-house Analysis (CWSs > 100K only)</u> Burden: 0.44 hrs/sample without LSLs; 0.89 hrs/sample with LSLs Cost: $3.92/sample without LSLs; $7.84/sample with LSLs <u>Commercial Analysis (CWSs ≤100K and all NTNCWSs)</u> $32.20/ sample without LSLs $57.20/sample with LSLs	<u>In-house Analysis</u> *hrs_analyze_samp_op*[3] *cost_lab_lt_samp*[3] <u>Commercial Analysis</u> *cost_5_commercial_lab*[3]
l) Prepare and submit sample invalidation request to State	2 hrs per sample per CWS and NTNCWS	*hrs_samp_invalid_op*
m) Inform consumers of tap sample results	<u>CWS per sample</u> Burden: 0.05 to 0.11 hrs Cost: $0.72 <u>NTNCWS per sample</u> Burden: 1 hr Cost: $0.079	<u>CWS</u> *hrs_inform_samp_op* *cost_cust_lt* <u>NTNCWS</u> *hrs_ntncws_inform_samp_op* *cost_ntncws_cust_lt*
n) Certify to the State that results were reported to consumers	0.66 to 1 hr per CWS or NTNCWS	*hrs_cert_cust_lt_op*

Activity	Unit Burden and/or Cost[1]	*SafeWater LCR Data Variable*
o) Submit request to renew 9-year monitoring waiver to the State	1 hr/9 years per qualifying CWS or NTNCWS	*hrs_renew_nine_op*
p) Submit sampling results and 90th calculation to the State	No LSLs: 2 to 3 hrs per CWS and NTNCWS With LSLs: 2.5 to 3.75 hrs per CWS and NTNCWS	*hrs_annual_lt_op*[3]
q) Oversee the customer-initiated lead sampling program	1 hr/sample per CWS	*hrs_cust_request_oversee_op*
r) Ship tap sampling material and instructions to participating households for customer-initiated lead sampling program	Burden per sample (CWSs only) 0.25 hrs Cost per sample (CWSs only) No LSLs: $8.57 to $11.33 With LSLs: $8.96 to $23.21	Burden *hrs_discuss_samp_op* Cost *cost_5_lt_samp*[3]
s) Collect lead tap samples for customer-initiated lead sampling program	Burden per sample (CWSs only) 0.40 to 0.71 hrs per CWS; Cost per sample (CWSs only) $5.75 to $10.24 per CWS	Burden *hrs_pickup_samp_op* Cost *cost_pickup_samp*
t) Analyze lead tap samples in-house or commercially for customer-initiated lead sampling program	In-house Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample without LSLs; 0.89 hrs/sample with LSLs Cost: $3.92/sample without LSLs; $7.84/sample with LSLs Commercial Analysis (CWSs ≤100K only) $32.20/ sample without LSLs $57.20/sample with LSLs	In-house Analysis *hrs_analyze_samp_op*[3] *cost_lab_lt_samp*[3] Commercial Analysis *cost_5_commercial_lab*[3]
u) Inform customers of lead tap sample results for customer-initiated lead sampling program	CWS per sample Burden: 0.05 to 0.11 hrs Cost: $0.72	CWS *hrs_inform_samp_op* *cost_cust_lt*

Acronyms: CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PWS = public water system.

Source: "Lead Analytical Burden and Costs_Final.xlsx." See Section 4.3.2.1 for a summary of how the unit burden is derived for each activity.

Notes:

[1] All activities other than one-time activities are per monitoring period. In addition, many of the activities listed above do not apply to NTNCWSs because unlike CWSs they collect their own samples from sampling locations under their control and thus, are unlikely to change sampling sites or reject samples for analysis. They also do not need to solicit sampling participation for customers or travel to their residences to pick up samples.

[2] In Arkansas, Louisiana, Mississippi, Missouri, North Dakota, and South Carolina the State sends sampling instructions to the water systems and thus are assumed to incur the burden to update the sampling instruction in lieu of the system (ASDWA, 2020a).

[3] In Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles, shipping, analysis, and providing sample results to the system. Thus, the State will incur the burden and cost for these activities in lieu of the system (ASDWA, 2020a).

a) ***Update sampling instruction for lead tap sampling and submit to the State (hrs_devel_samp_op).*** All CWSs and NTNCWSs will incur a one-time burden to update their sampling instructions to be consistent with the revised tap sampling procedures related to the prohibition of aerator removal and pre-stagnation flushing, and the requirement to use wide-mouth bottles for sample collection. Systems are assumed to use an EPA template provided by the State as the basis for updating their sampling instructions and would require 2 hours per system. The EPA also assumed systems would submit their revised instructions electronically and would not incur non-labor costs.

b) ***Contact homes to establish new 100 percent LSL tap sampling pool (hrs_add_lsl_samp_op).*** Under the LCRI, CWSs with LSLs incur a one-time burden to contact additional residents to have enough volunteers to collect all samples from sites served by LSLs meeting their minimum required number of tap samples. The estimated burden associated with this activity *(hrs_add_LSL_samp_op)* is provided in Exhibit 4-11 below. The burden would only apply to those systems with LSLs. See Chapter 3, Section 3.3.4.1 for the percentage of CWSs with LSLs *(p_lsl)*. The EPA assumed that CWS without LSLs will not need to update their initial sampling pool because they are subject to less restrictive sampling criteria regarding the age of the copper and lead solder sites under the LCRI. Specifically, these systems no longer need to prioritize sampling at sites with copper pipes and lead solder installed after 1982. In addition, NTNCWSs generally have control over their entire distribution system and are not expected to incur this additional burden.

Exhibit 4-11: CWS Burden to Achieve a Sampling Pool with 100 Percent Lead Service Line Sites

System Size (Population Served)	Required number of samples for standard monitoring	Number of new sites needed for systems with LSLs	Total hours to recruit one new LSL sample location	Total hours per system to contact residences and obtain required additional LSL sample locations
	numb_samp_customer			*hrs_add_LSL_samp_op*
	A	**B = A*50%**	**C**	**D = B*C**
≤100	5	2.5	2	5
101-500	10	5	2	10
501-3,300	20	10	2	20
3,301-10,000	40	20	2	40
10,001-100,000	60	30	2	60
>100,000	100	50	2	100

Acronyms: CWS = community water system; LSL = lead service line.
Notes:
A: Exhibit 4-9, column A.
C: Based on a November 2, 2018 meeting with Philadelphia Water Department (PWD) regarding steps PWD takes in response to a high lead level at an individual residence (available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov). Of the 263 people contacted at residences with potential LSLs sites, only 71 had LSLs. This is approximately 25 percent of contacted customers. Based on this information, the EPA assumed that a water

system would need to contact four residences to obtain one new LSL site for their sampling program and would require 0.5 hours per resident. This may be an overestimate because LSL systems will be updating their LSL inventory to identify residences with LSLs. Thus, they may need to contact fewer residences to find those with LSLs that are interested in participating in the sampling program.

c) ***Update and submit tap sampling plan to the State (hrs_samp_plan_op).*** Systems must submit tap sampling plans to the State prior to the initial monitoring period under the final rule. This is a one-time burden. The EPA estimated systems with no LSLs will require 2 hours, 4 hours, and 6 hours for systems serving 3,300 or fewer people, systems serving 3,301-100,000 people, and systems serving greater than 100,000 people, respectively. The EPA assumed systems with LSLs will require more time to prepare their plans for submission to the State. The EPA estimated systems with LSLs will require 8 hours, 16 hours, and 20 hours for systems serving 3,300 or fewer, systems serving 3,301-100,000, and systems serving greater than 100,000, respectively. These estimates are twice the State burden for reviewing sampling plans (*hrs_rev_samp_plan_js*). As discussed in Section 4.4.2.1, activity b), these estimates are based on the ASDWA 2020 CoSTS model, section "Tap Sampling" (ASDWA, 2020b). The EPA did not use estimates from the ASDWA 2024 CoSTS model because estimates in the 2020 model were more conservative.

d) ***Report any changes in sampling locations to the State (hrs_chng_tap_op).*** Systems must report any changes in their tap sampling locations from the prior monitoring period and the reason for the change. Water systems must include the number of customers that are non-responsive after two attempts or refused to participate. The EPA estimates CWSs will require 3 hours per monitoring period to submit this documentation based on the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 (Move Tap Sampling Location) (USEPA, 2022a). The EPA assumed CWSs would have changes in monitoring locations every monitoring period, starting in Year 5, due to customers dropping out of the testing program. NTNCWSs are not assumed to incur this burden because in general they have control over their entire distribution system and, unlike CWSs, should have access to all sampling locations. Thus, the EPA assumed NTNCWS would be unlikely to change tap sampling locations. Note that this assumption would underestimate burden in those instances in which a NTNCWS had to change sampling sites (*e.g.*, the site no longer meets the tiering criteria because the LSL was removed). However, the EPA anticipates that once all LSLs are removed, a NTNCWS' sampling plan would remain static.

e) ***Confer with the State on initial lead sampling data and status under the LCRI (hrs_initial_tap_confer_op).*** The EPA assumed systems will incur one-time burden in Year 4 to discuss their requirements with the State based on their most recent two six-month monitoring periods. The EPA assumes each system will incur a burden of 2 hours for this consultation. The EPA assumed a 2 hour consultation burden is consistent with other types of consultations and is based on the estimated burden for systems to consult with their State on public education activities from pg. 60 of the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule (USEPA, 2007). This estimate was increased from 1 hour per system from the *Economic Analysis for the Proposed Lead and Copper Rule Improvements* (hereafter

referred to as the "Proposed LCRI EA" (USEPA, 2023c). The EPA changed this estimate to be consistent with estimates for other types of consultation in the final rule.

f) ***Obtain households for each round of lead tap sampling (hrs_samp_volunt_op).*** For each monitoring period, CWSs will contact customers from the tap sampling pool (see b above) to obtain volunteers to participate in the lead tap sampling program. The EPA assumed:

- CWSs will contact customers by phone.
- CWSs will spend 20 minutes with those that agree to participate to explain the program, or 50 percent of customers, and 5 minutes with those that do not, for an average of 15 minutes or 0.25 hours per sample.
- CWSs without LSLs will contact two customers for every one sample, resulting in an average burden of 0.5 hours per sample.
- CWSs with LSLs must contact additional customers because they must collect all samples from LSL sites and previous sites will become ineligible if LSLs are replaced. The EPA assumed these systems will contact four customers for every one sample, resulting in an average burden of 1 hour.

An important input for this activity is the number of customers that are contacted each monitoring period. The EPA started with the required number of samples (*numb_samp_customer* or *numb_reduced_tap* from Section 4.3.2.1.1) and increased it to recognize that systems commonly start with a larger sampling pool to account for situations where customers do not actually take the sample, the sample is rejected for improper sampling protocol methods, or invalidated after it is analyzed. For modeling purposes, the EPA inflated the starting number of customers in the sampling pool using the following percentages:

- **1 – *pp_hh_return_samp***: The EPA assumed that 90 percent of volunteer customers would collect their lead sample each monitoring period, with 1 – 90 percent, or 10 percent not returning their sample bottles to be picked up by the water system. This likelihood is based on New York City's Department of Environmental Protection response to an EPA 2016 questionnaire[102] about their voluntary lead testing program in which they indicated that customers returned the test kits 50 percent of the time. The EPA assumed a higher return rate of 90 percent because CWSs will have contact with their customers prior to sample collection as opposed to customer-initiated sampling that may be done via a website. This likelihood does not apply to NTNCWSs.
- ***pp_samp_reject***: The EPA assumed CWSs would reject 5 percent of samples prior to sample analysis based on the sample rejection rate provided by the City of Chicago Department of Water Management (DWM) regarding their free customer-request testing program. The

[102] The EPA sent a questionnaire in 2016 to the New York City Department of Environmental Protection and the Chicago Department of Water Management (DWM) regarding their free testing programs for lead in drinking water. The purpose of this questionnaire was to give the EPA a sense of the burden and cost associated with implementing such a program. The questionnaire and responses are available in the docket (EPA-HQ-OW-2022-0801 at www.regulations.gov).

DWM indicated they reject approximately 26 percent of test kits for improper sampling procedures. The EPA assumed a lower rejection rate because customers will collect one sample as opposed to the three sets of samples that are part of Chicago's sampling protocol.[103] In addition, some customers participate in multiple sampling events and should be familiar with the sample collection protocol. Also refer to activity j) for the burden to CWSs to determine if a sample should be rejected (*hrs_samp_reject_op*). The EPA assumed NTNCWSs would not reject any samples because they collect their own samples and should be familiar with the sampling protocol.

- ***pp_samp_invalid***: The EPA estimated that a small percentage (0.6 percent) of samples will be invalidated by the State after the sample is analyzed. This estimate is based on the average of Indiana and North Carolina's response to a 2016 ASDWA survey regarding the number of invalidation requests per year. Indiana indicated they receive about 15 invalidations per year or 1.1 percent of their 1,375 CWSs and NTNCWSs. North Carolina responded they have 1 to 2 requests per year. This translates to 0.08 percent using the higher number of requests of 2 per the 2,375 CWSs and NTNCWSs in North Carolina. The EPA used the average of the two percentages, approximately 0.6 percent. The EPA assumed the same invalidation percentage for CWSs and NTNCWSs across all system sizes. Refer to activity l) for the burden to systems to prepare and submit a sample invalidation request to the State (*hrs_samp_invalid_op*). A copy of the questionnaire and each State's responses are available in the docket under EPA-HQ-OW-2022-0801 at www.regulations.gov.

g) Offer incentives to households to encourage participation in lead tap sampling program (cost_incentive). Some CWSs offer monetary incentives to their customers to encourage their participation in their lead tap sampling program. Other systems elect not to or are prohibited from providing financial incentives. The EPA considered the following information provided by the Greater Cincinnati Water Works (GCWW) for 12 water systems in developing the likelihood that a system would offer an incentive and the amount of that incentive:

- Three systems (25 percent) offered no incentives.
- Nine systems offered incentives ranging from $10 to $100. Most (four) offered $25. Two systems offered $10, one system each offered $20, $50, and $100.

Based on this information, the EPA:

- Assumed 75 percent of systems would offer incentives during each monitoring period in order to obtain customer participation (*p_incentive*).
- Set a minimum and maximum value by size category due to the variability across the 12 systems (*cost_incentive*). The EPA assumed systems serving 3,300 or fewer people would not have the financial resources to offer large incentives and thus, set a minimum and maximum of $10 and $20, respectively. The EPA assumed systems serving more than 3,300 would offer a minimum and maximum of $25 and $100, respectively.

[103] Chicago DWM's free testing program includes three bottles and instructions for an initial first-draw, a 3 minute flush, and a 5 minute flush.

The EPA assumed that incentives are only provided to customers that collect a sample that is not later rejected or invalidated.

h) ***Ship tap sampling materials and instructions (hrs_discuss_samp_op, cost_5_lt_samp).*** The rule allows customers to collect tap samples after receiving proper instructions from the water system. The EPA assumed each CWS will spend an average of 0.25 hours to discuss sampling instructions with customers *(hrs_discuss_samp_op)*. This estimate is based on information provided by Chicago DWM regarding its water testing program. DWM responded that on average staff required 0.25 hours to send out test kits. The EPA assumed this burden included time to discuss sampling instructions with volunteers and prepare the sampling kit for shipment.

The EPA assumed CWSs will ship sampling materials to customers. Thus, CWSs will also incur non-labor costs for a CWS to provide a test kit (including bottles and instructions) and ship the kits to customers *(cost_5_lt_samp)*. The inputs and assumptions for this cost are provided in Exhibit 4-12 for systems without LSLs and in Exhibit 4-13 for systems with LSLs.

Exhibit 4-12: Non-Labor Costs for CWS without LSLs to Provide Test Kits (per Sample)

System Size (Population Served)	Test Kit Cost	Shipping Cost to customers	Total Non-Labor Costs to Provide Test Kits
			cost_5_lt_samp
	A	**B**	**C = A+B**
≤3,300	$1.27	$7.50	$8.77
3,301-100,000	$1.07	$7.50	$8.57
>100,000	$3.83	$7.50	$11.33

Notes:
A: The sample test kit includes a shipping container, bottle label, resealable plastic bag, directions and chain of custody form, and an empty bottle. The cost for CWSs serving 3,301 to 100,000 people is lower because these systems are assumed to buy a larger quantity of shipping containers and incur a lower per container cost. CWSs serving more than 3,300 people are assumed to buy the shipping container in bulk. CWSs serving 100,000 or fewer are assumed to use a commercial laboratory and the cost of the bottle is included as part of the analytical fee. See file, “Lead Analytical Burden and Costs_Final.xlsx,” worksheet “Tap_Collect_Analyze_CWS_LCRI.”
B: The EPA estimated the sample kit to weigh 0.23 pounds. The 2020 USPS retail ground shipping costs for Zones 1 or 2 for a package of one pound or less is $7.50. Postage costs are available at https://pe.usps.com/Archive/NHTML/DMMArchive20201018/Notice123.htm#_c037%20 (Accessed 6.27.2022).
C: The cost of a test kit is $0.02 lower than the Proposed LCRI EA (USEPA, 2023c) cost estimate due to an adjustment in the cost of ink.

Exhibit 4-13: Non-Labor Costs for CWS with LSLs to Provide Test Kits (per Sample)

System Size (Population Served)	Test Kit Cost	Shipping Cost to customers	Total Non-Labor Costs to Provide Test Kits
			cost_5_lt_samp
	A	B	C = A+B
≤3,300	$1.73	$7.50	$9.23
3,301-100,000	$1.46	$7.50	$8.96
>100,000	$15.71	$7.50	$23.21

Notes:

A: The sample test kit includes a shipping container, bottle label, resealable plastic bag, directions and chain of custody form, and five empty bottles. The cost for CWSs serving 3,301 to 100,000 people is lower because these systems are assumed to buy a larger quantity of shipping containers and incur a lower per container cost. CWSs serving more than 3,300 people are assumed to buy the shipping container in bulk. CWSs serving 100,000 or fewer are assumed to use a commercial laboratory and the cost of the bottle is included as part of the analytical fee. The sample kit cost is higher for systems with LSLs because the EPA assumed CWSs would need a larger shipping container to accommodate five versus one sample bottle. See file, "Lead Analytical Burden and Costs_Final.xlsx," worksheet "Tap_Collect_Analyze_CWS_LCRI." The test kit cost for CWSs with LSLs that serve more than 100,000 people includes the cost of four additional 1-liter bottles. For CWSs serving 100,000 or fewer with LSLs, the additional bottle costs are reflected in a higher commercial laboratory cost. See activity k) below.

B: The EPA estimated the sample kit to weigh 0.23 pounds. The 2020 USPS retail ground shipping costs for Zones 1 or 2 for a package of one pound or less is $7.50. Postage costs are available at https://pe.usps.com/Archive/NHTML/DMMArchive20201018/Notice123.htm#_c037%20 (Accessed 6.27.2022).

C: The cost of a test kit is $0.01 lower than the Proposed LCRI EA (USEPA, 2023c) cost estimate due to a formula adjustment.

These unit costs are combined with the total number of tap sampling locations to produce the total cost in the SafeWater LCR model. To estimate the number of tap sampling locations, the EPA inflated the number of required samples for CWSs (*numb_samp_customer* or *numb_reduced tap* from Section 4.3.2.1.1) by the likelihood a customer would not collect the sample of 10 percent (1 – *pp_hh_return_samp*), the likelihood that the sample would be rejected of 5 percent (*pp_samp_reject*), and the likelihood that a sample would be invalidated of 0.6 percent (*pp_samp_invalid*). See activity f) for a more detailed discussion of these likelihoods.

i) Collect lead tap samples (hrs_pickup_samp_op, cost_pickup_samp). The EPA assumed CWSs will pick up filled sample bottles versus having the customer ship them back. The agency has heard from a number of systems that picking up the sample bottles ensures a demonstrable chain of custody for the sample and ensures no damage to the sample before being analyzed by the laboratory. The system will incur burden and O&M costs to travel round-trip to pick-up a sample from each customer who participated in the sampling event. The EPA calculated the average driving distance for each of the nine system size categories used in the SafeWater LCR model. For CWSs serving 100,000 or fewer people, the EPA calculated the total service area for each active CWS in SDWIS/Fed with available zip code information from the 2006 CWSS and Zip

Code Tabulation Areas from United States Census Bureau's Geography program TIGER GIS data (2020 release of 2010 decennial geographies). For CWSs serving more than 100,000 people, the EPA determined the service area from the county information reported to SDWIS/Fed or the city's area. The latter was used for those CWSs that have system names identifying the city served (e.g., the CWS "San Diego, City Of").

The EPA summed the total service area for all systems in each of the nine system size categories. The EPA assumed each service area could be approximated by a circular shape and estimated the average driving distance as 2/3 the radius of the service area. Due to the limited availability of service area zip code information available in the 2006 CWSS,[104] the EPA used a weighted average for all systems serving 100,000 or fewer people based on the representativeness of the sample of systems with zip code information and the total number of systems within each size category. A summary of this analysis is presented in Exhibit 4-14 and additional data can be found in the file, "Estimated Driving Distances_Final.xlsx."

The EPA also assumed systems would travel an average speed of 25 miles per hour to pick up a lead sample from participating customers that equals a burden of 0.4 to 0.71 *(hrs_pickup_samp_op)*, depending on the system size as shown in Column C of Exhibit 4-14 below. In addition, the EPA used the Federal mileage reimbursement rate of $0.575 per mile to calculate an average cost of $5.75 to $10.24 (*cost_pickup_samp*) per trip based on system size as shown in Column E of Exhibit 4-14.

Similar to previous activities, an important input is the number of locations at which systems collect lead tap samples. The EPA started with the required number of samples for CWSs (*numb_samp_customer* or *numb_reduced tap* in Section 4.3.2.1.1) and increased it by the likelihoods a customer would not collect the sample of 10 percent (1 – *pp_hh_return_samp*), the sample would be rejected of 5 percent (*pp_samp_reject*), and the sample would be invalidated of 0.6 percent (*pp_samp_invalid*).

Exhibit 4-14: Travel Burden and Cost for Lead Tap Sample Pickup

System Size (Population Served)	Miles one way	Time one way (hrs)	Time Roundtrip (hrs) *hrs_pickup_samp_op*	2020 Mileage Rate	2020 Vehicle Cost *cost_pickup_samp*
	A	B=A/25	C= B*2	D	E = A*2*D
≤100,000	5.0	0.20	0.40	$0.575	$5.75
100,001 – 1,000,000	6.4	0.26	0.51	$0.575	$7.36
>1,000,000	8.9	0.36	0.71	$0.575	$10.24

Source: See file "Estimated Driving Distances_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Notes:

A & B: Geographic extent of water systems from the 2006 Community Water Systems Survey, and Census Data. See file "Estimated Driving Distances_Final.xlsx" for derivation of mileage. Assumed travel speed of 25 mph.

[104] Between 1 and 13 percent of CWSs serving 100,000 or fewer were currently active systems with zip code information from the 2006 CWSS. For systems serving 100,000 to 1 million people, 6 percent and 100 percent of CWSs were included in the average driving distance estimates, respectively.

D: Vehicle O&M based on Federal reimbursement rate of $0.575 (2020 mileage rate).

NTNCWSs collect their own samples and are assumed to require 0.5 hours to collect a sample *(hrs_pickup_samp_op)*. This burden is based on the estimated source water sample collection burden from the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (Exhibit 15) (USEPA, 2022a). The EPA inflated the number of required samples for NTNCWS by the likelihood a sample would be invalidated of 0.6 percent (*pp_samp_invalid*) to account for the additional burden for a NTNCWS to collect another sample. See activity f) for a more detailed discussion of this likelihood.

j) Determine if a sample should be rejected and not analyzed (hrs_samp_reject_op). CWSs will determine if samples collected by customers meet the required sampling protocol and if any should be rejected prior to analysis. For example, the sample volume may not be one-liter or a review of the chain-of-custody information could indicate the customer did not follow other proper sampling procedures. The EPA assumed systems would spend an average of 15 minutes or 0.25 hours per rejected sample *(hrs_samp_reject_op)*.

The unit burden is multiplied by the number of samples that the system receives from customers, which is estimated as the required number of rejected samples (*numb_samp_customer* or *numb_reduced tap* from Section 4.3.2.1.1) multiplied by the 5 percent likelihood that the sample would be rejected (*pp_samp_reject*).

As discussed under activity f), the EPA assumed all NTNCWSs collect their own samples and should be familiar with the sampling protocol and thus would not incur burden to determine if a sample should be rejected.

k) Analyze lead tap samples in-house or commercially (hrs_analyze_samp_op, cost_lab_lt_samp, cost_5_commercial_lab). Based on input from seven laboratories, the EPA assumed only CWSs serving more than 100,000 people will have in-house capabilities to analyze lead. All NTNCWSs and all other CWSs are assumed to use a commercial laboratory for lead analysis. Thus, the likelihood that a model PWS will conduct lead analyses in-house *(pp_lab_samp)* is 1 for CWSs serving more than 100,000 people and 0 for all other systems. Conversely, the assigned likelihood that a system will use a commercial lab for lead, or *pp_commercial_samp*, is 0 for CWSs serving more than 100,000 people and 1 for all other systems.

Based on estimates provided by three laboratories, the EPA assumed that CWSs serving 100,000 would incur an in-house lead analytical burden of 0.44 hours per sample *(hrs_analyze_samp_op).* This burden includes sample preparation, sample analysis, quality control checks and data entry. Refer to “Lead Analytical Burden and Costs_Final.xlsx,” worksheet “In-House Burden_hrs” for additional information. For samples collected by CWSs serving more than 100,000 people from a site served by an LSL, both a first- and fifth-liter sample must be analyzed and the analytical burden would be double or 0.89 hours per system. CWSs conducting in-house analyses would also incur non-labor costs for analytical materials such as preservatives, calibration standards, and quality assurance (QA) standards of $3.92 per sample from a non-lead service line site and $7.84 for a first- and fifth-liter sample from an LSL site *(cost_lab_lt_samp)* based on quotes from three vendors. See

worksheet “In_House_Consumables_Summary_$,” in the file, “Lead Analytical Burden and Costs_Final.xlsx.”

The EPA assumed CWSs serving 100,000 or fewer people and all NTNCWSs that collected lead samples from sites served by non-lead service lines would incur an average cost of $23.50 for a lead sample analysis conducted by a commercial laboratory, based on estimates from seven laboratories, and a cost of $8.70 to ship the sample to the laboratory for a total per sample cost of $32.20 *(cost_5_commercial_lab)*. See worksheet “Commercial Analytical_$” in the file “Lead Analytical Burden and Costs_Final.xlsx” for additional information. The EPA increased this estimate for systems with LSLs to account for the analysis and shipping of a first- and fifth-liter sample of $23.50*2 or $47.00 plus a cost to ship two bottles to the laboratory at $10.20 for a total cost of $57.20 per sample.

The unit costs are multiplied by the number of samples analyzed each monitoring period to produce total costs. The EPA began with the required number of samples (*numb_samp_customer* or *numb_reduced tap* from Section 4.3.2.1.1) and increased it by the 0.6 percent likelihood the sample would be invalidated (*pp_samp_invalid*) to estimate the number of samples analyzed in-house or commercially. Note that the number of samples analyzed does not include those rejected by the water system because they are not analyzed.

l) Prepare and submit a sample invalidation request to State (hrs_samp_invalid_op). Some CWSs and NTNCWSs will request that the State invalidate a lead tap sample. The EPA assumed that systems will not require extensive time to prepare and submit their sample invalidation requests because the rule provides the allowable criteria for sample invalidation. The EPA assumed systems will incur a burden of 2 hours per request *(hrs_samp_invalid_op)* based on Indiana’s and North Carolina’s responses to a questionnaire. A copy of the questionnaire and each State’s responses are available in the docket under EPA-HQ-OW-2022-0801 at www.regulations.gov.

The EPA estimated that 0.6 percent of samples will be invalidated for CWSs and NTNCWSs *(pp_samp_invalid*), as previously discussed in activity f). As a simplifying assumption, the EPA assumed the State will grant all sample invalidation requests. Thus, the likelihood a system will request sample invalidation is equal to the likelihood that a sample will be invalidated.

m) Inform consumers of tap sample results (hrs_inform_samp_op, cost_cust_lt, hrs_ntncws_inform_samp_op, cost_ntncws_cust_lt). CWSs must report individual lead and copper sample results to consumers who participated in the tap monitoring program as well as consumers who request sampling under the LCRI final (see activity q) for additional detail). The EPA estimates that systems serving 3,300 or fewer people will require an average of 0.05 hours per consumer *(hrs_inform_samp_op)*, while systems serving greater than 3,300 people will require an average of 0.11 hours per consumer. This estimate is based on the public education burden for systems to notify occupants of monitoring results estimated as part of the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (Exhibit 39) (USEPA, 2022a). This ICR assumed a burden of 1 hour per 20 letters for all systems serving 3,300 or fewer people and a burden of 1 hour per 9 letters for systems serving greater than 3,300 people. Systems are also assumed to mail these results at a cost in 2020 dollars of $0.72 *(cost_cust_lt)* that includes postage ($0.55), and paper, ink, and envelope costs based on three vendors of $0.019, $0.092, and $0.06, respectively (see “General Cost Model Inputs_Final.xlsx”).

NTNCWSs are also required to provide sampling results to the people they serve. For NTNCWSs, the EPA assumed the systems will deliver materials via email to all customers and post in a public location at a burden of 1 hour for all system sizes *(hrs_ntncws_inform_samp_op)*. This estimate includes 0.5 hours to develop and send the e-mails and an additional 0.5 hours to post public education materials publicly. The EPA assumed NTNCWSs will incur paper and ink costs of $0.019 and $0.06, respectively, *(cost_ntncws_cust_lt)* to post the flyer.

n) ***Certify to State that results were reported to consumers (hrs_cert_cust_lt_op).*** The EPA assumed CWSs and NTNCWSs serving 50,000 or fewer people will incur a burden of 0.66 hours per monitoring period to prepare and submit a certification that consumers who participated in the compliance sampling or requested samples, were notified of their sampling results. Those serving more than 50,000 people will incur a burden of 1 hour for this activity. The burden estimates of 0.33 hours and 0.5 hours are based on North Carolina and Indiana's response, respectively, to a 2016 ASDWA questionnaire regarding the estimated burden to review these certifications. The EPA assumed systems would require twice the burden to prepare these certifications than would be required for the State to review them. The EPA used the higher estimated burden from Indiana for systems serving more than 50,000 people because these systems collect a larger number of samples than smaller systems and thus, would be certifying that they reported results to more consumers. The EPA assumed systems will submit this certification electronically and thus incur no paper or mailing costs.

o) ***Submit request to renew 9-year monitoring waiver to the State (hrs_renew_nine_op).*** CWSs and NTNCWSs on 9-year monitoring waivers must submit documentation to the State every 9 years that demonstrates their system and their customers continue to have no lead- or copper-containing plumbing materials. As discussed in Section 3.3.7.1, the EPA assumed only a subset of systems serving 1,000 or fewer people would qualify for this waiver. The EPA assumed systems will incur a burden of 1 hour for this request based on the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 (Monitoring Waiver Application) (USEPA, 2022a). See file, "Pb Schedules_CWS_Final.xlsx" for additional information on how the EPA estimated the number of systems with 9-year monitoring waivers.

p) ***Submit sampling results and 90th percentile calculations to the State (hrs_annual_lt_op).*** The EPA estimated the burden for CWSs and NTNCWSs to submit tap sampling results and their 90th percentile calculations, and the number of customers that were non-responsive after two attempts or refused to participate in the sampling program. The burden is provided in for systems with and without LSLs with more detailed assumptions provided in the exhibit notes. These estimates were doubled from the proposed rule to mirror changes to State burden *(hrs_annual_lt_js)* in Section 4.4.2.1 that are based on the ASDWA 2024 CoSTS model, section "Tap Sampling" (ASDWA, 2024).

Exhibit 4-15: Burden to Submit Lead Tap Sampling Results and 90th Percentile Level

System Size (Population Served)	Provide Lead Tap Sampling Results and 90th percentile Calculation (hrs/system/monitoring period)	
	hrs_annual_lt_op	
	A	B=A*1.25
	No LSL	LSL
≤10,000	2	2. 5
10,001-100,000	2. 5	3.13
> 100,000	3	3.75

Acronyms: LSL = lead service line.
Notes:
A: Burden based on the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 35 (Tap Sample Calcs) (USEPA, 2022a) and ASDWA's 2024 CoSTS model, section "Tap Sampling" (ASDWA, 2024).
B: LSL systems must also provide documentation if they have an insufficient number of sites served by LSLs that are needed to meet minimum sampling requirements. Thus, the EPA assumed an additional 25 percent burden for LSL systems.

q) Oversee the customer-initiated lead sampling program (hrs_cust_request_oversee_op). Under the final LCRI, CWSs that exceed the final lead AL of 10 µg/L must make the offer to sample the tap water of any customer who requests it more prominent in their public education materials. This offer must also be included as part of the targeted outreach to customers with lead, GRR, or unknown service lines. The final LCRI does not require CWSs to bear the sampling costs but for modeling purposes, the EPA assumed CWSs would pay for the sample collection and analysis. The EPA assumed the likelihood of a customer requesting a lead tap sample (*p_customer_request*) to be 1% based on the testing program of five water systems. See file, "Customer Requested Sampling Percent_Final.xlsx" for additional detail. The EPA also assumed systems would require 1 hour per sample administrative burden to ensure customer's requests were properly fulfilled (*hrs_cust_request_oversee_op*). In addition, systems would incur the same burden and costs for shipping sampling materials, sample collection, analysis, and informing customer of results associated with a first liter sample from non-lead service line sites and a first- and fifth-liter sample from LSL sites previously described under activities:

- h) Ship tap sampling material and instructions to participating households (*hrs_discuss_samp_op*, *cost_5_lt_samp*);
- i) Collect lead tap samples (*hrs_pickup_samp_op*, *cost_pickup_samp*);
- k) Analyze lead tap samples in-house or commercially (*hrs_analyze_samp_op*, *cost_lab_lt_samp, cost_5_commercial_lab*); and
- m) Inform consumers of lead tap sample results (*hrs_inform_samp_op, cost_cust_lt, cost_ntncws_cust_lt).*

Exhibit 4-16 shows the SafeWater LCR model cost estimation approach for system lead tap sampling activities. As shown in the exhibit, the SafeWater LCR model relies upon additional inputs, such as number of samples for lead tap sampling and the likelihood a system is below an AL, to compute the cost per activity. For example, unit costs for activity l) to prepare and submit sample invalidation requests to State is the product of the required number of samples, the likelihood of sample invalidation, the burden to prepare and submit the sample invalidation request, and the PWS hourly rate. A description of the data variables and section where they are described in more detail are provided in footnote 1 to the exhibit.

r) ***Ship tap sampling materials and instructions for customer-initiated lead sampling program (hrs_discuss_samp_op, cost_5_lt_samp).*** See activity h) for discussion of burden estimates.

s) ***Collect lead tap samples for customer-initiated lead sampling program (hrs_pickup_samp_op, cost_pickup_samp).*** See activity i) for discussion of burden estimates.

t) ***Analyze lead tap samples in-house or commercially for customer-initiated lead sampling program (hrs_analyze_samp_op, cost_lab_lt_samp, cost_5_commercial_lab).*** See activity k) for discussion of burden estimates.

u) ***Inform customers of lead tap sample results for customer-initiated lead sampling program (hrs_inform_samp_op, cost_cust_lt, hrs_ntncws_inform_samp_op, cost_ntncws_cust_lt).*** See activity m) for discussion of burden estimates.

Exhibit 4-16: PWS Lead Tap Sampling Cost Estimation in SafeWater LCR by Activity[1,2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
a) Update sampling instructions for lead tap sampling and submit to the State[3]				
Total hours per system multiplied by the system labor rate. *(hrs_devel_samp_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
b) Contact homes to establish new 100 percent LSL tap sampling pool				
Total hours per system multiplied by the system labor rate. *(hrs_add_lsl_samp_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead or unknown content	One time
c) Update and submit tap sampling plan to the State				
Total hours per system multiplied by the system labor rate. *(hrs_samp_plan_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
d) Report any changes in sampling locations to the State[4]				

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
Total system hours per monitoring period multiplied by the system labor rate. *(hrs_chng_tap_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		Above AL	All model PWSs not doing POU sampling	Twice a year
e) Confer with the State on initial lead monitoring data and status under the LCRI				
Total system hours multiplied by the system labor rate. *(hrs_initial_tap_confer_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One Time
f) Obtain households for each round of lead tap sampling				
The number of required samples per system multiplied by the hours per sample and the system labor rate. The number of required samples is inflated to include those unreturned, invalidated, and rejected to ensure that	Cost does not apply to NTNCWSs.	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_samp_customer+(numb_samp_customer*(1-pp_hh_return_samp))+(numb_samp_customer*pp_samp_invalid)+(numb_samp_customer*pp_samp_reject))*(hrs_samp_volunt_op*rate_op)*				
		Above AL	All model PWSs not doing POU sampling	Twice per year
The number of required samples per system multiplied by the hours per sample and the system labor rate. The number of required samples is inflated to include those unreturned, invalidated, and rejected to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_reduced_tap+(numb_reduced_tap*(1-pp_hh_return_samp))+(numb_reduced_tap*pp_samp_invalid)+(numb_reduced_tap*pp_samp_reject))*(hrs_samp_volunt_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below AL	Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS is on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
g) Offer incentives to households to encourage participation in lead tap sampling program				
The number of required samples per system multiplied by the cost of the incentive. This number is not inflated by the number of samples deemed invalid or rejected because it is assumed that if a sample is invalid or rejected the system will return to the same customer to resample. The EPA also assumes that unreturned samples would not be eligible for an incentive. numb_samp_customer*cost_incentive	Cost does not apply to NTNCWSs.	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling that offers an incentive 1 - (p_tap_annual + p_tap_triennial + p_tap_nine)] * p_incentive	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling that offers an incentive p_tap_annual * p_incentive	Once a year
		Above AL	Model PWS not doing POU sampling that offers an incentive p_incentive	Twice per year
The number of required samples per system multiplied by the cost of the incentive. This number is not inflated by the number of samples deemed invalid or rejected, because it is assumed that if a sample is invalid or rejected the system will return to the same customer to resample. The EPA also assumes that unreturned samples would not be eligible for an incentive. numb_reduced_tap*cost_incentive	Cost does not apply to NTNCWSs.	At or below AL	Model PWS on triennial reduced tap sampling and not doing POU sampling that offers an incentive p_tap_triennial * p_incentive	Every 3 years
			Model PWS on nine-year reduced tap sampling and not doing POU sampling that offers an incentive p_tap_nine * p_incentive	Every 9 years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
h) Ship tap sample monitoring materials and instructions to participating households[5]				
Number of required samples multiplied by the total of the hours per sample to provide instructions times the system labor rate, plus the cost of materials per sample. The number of required samples is inflated to include those unreturned, invalidated, and rejected, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_samp_customer+(numb_samp_customer*(1-pp_hh_return_samp))+(numb_samp_customer*pp_samp_invalid)+(numb_samp_customer*pp_samp_reject))*((hrs_discuss_samp_op*rate_op)+cost_5_lt_samp)*	To calculate the sampling material costs for NTNCWSs this equation is still used. Number of required samples multiplied by the cost of materials per sample. The number of required samples is inflated to include those invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((numb_samp_customer+(numb_samp_customer*pp_samp_invalid))*cost_5_lt_samp)*	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
		Above AL	All model PWSs not doing POU sampling	Twice per year
Number of required samples multiplied by the total of the hours per sample to provide instructions times the system labor rate, plus the cost of materials per sample. The number of required samples is inflated to include those unreturned, invalidated, and rejected, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_reduced_tap+(numb_reduced_tap*(1-*	To calculate the sampling material costs for NTNCWSs this equation is still used. Number of required samples multiplied by the cost of materials per sample. The number of required samples is inflated to	At or below AL	Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
*pp_hh_return_samp))+(numb_reduced_tap*pp_samp_invalid)+(numb_reduced_tap*pp_samp_reject))*((hrs_discuss_samp_op*rate_op)+cost_5_lt_samp)*	include those invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((numb_reduced_tapr+(numb_reduced_tap*pp_samp_invalid))*cost_5_lt_samp)*			
			Model PWS on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
i) Collect lead tap samples				
The number of required samples per system multiplied by the hours per sample and the system labor rate. The number of required samples is inflated to include those invalidated and rejected to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_samp_customer+(numb_samp_customer*pp_samp_invalid)+(numb_samp_customer*pp_samp_reject)+(numb_samp_customer*(1-pp_hh_return_samp))*((hrs_pickup_samp_op*rate_op)+cost_pickup_samp)*	Cost applies as written to NTNCWSs.	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
		Above AL	All model PWSs not doing POU sampling	Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90^{th} - Range	Other Conditions[2]	
The number of required samples multiplied by the total of the hours per sample to provide instructions times the system labor rate, plus the cost of materials per sample. The number of required samples is inflated to include those unreturned, invalidated, and rejected, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(numb_reduced_tap+(numb_reduced_tapr*pp_samp_invalid)+(numb_reduced_tap*pp_samp_reject)+(numb_reduced_tap*(1-pp_hh_return_samp))*((hrs_pickup_samp_op*rate_op)+cost_pickup_samp)*	Cost applies as written to NTNCWSs.	At or below AL	Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
j) Determine if a sample should be rejected and not analyzed				
The number of samples expected to be rejected (calculated by multiplying the total number of required samples by the likelihood of rejection) multiplied by the hours per sample and the system labor rate. *(numb_samp_customer*pp_samp_reject)*(hrs_samp_reject_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
		Above AL	All model PWSs not doing POU sampling	Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
The number of samples expected to be rejected (calculated by multiplying the total number of required samples by the likelihood of rejection) multiplied by the hours per sample and the system labor rate. *(numb_reduced_tap*pp_samp_reject)*(hrs_samp_reject_op*rate_op)*	Cost does not apply to NTNCWSs.	At or below AL	Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
k) Analyze lead tap samples in-house or commercially[5]				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. The number of samples is inflated to include those invalidated, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(((numb_samp_customer+(numb_samp_customer*pp_samp_invalid))*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((numb_samp_customer+(numb_samp_customer*pp_samp_invalid))*pp_commercial_samp)*((hrs_analyze_samp_op*rate_op)+cost_5_commercial_lab))*	Cost applies as written to NTNCWSs.	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling *1 - (p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
		Above AL	All model PWSs not doing POU sampling	Twice per year
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. The number of samples is inflated to include those invalidated, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(((numb_reduced_tap+(numb_reduced_tap*pp_samp_invalid))*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((numb_reduced_tap+(numb_reduced_tap*pp_samp_invalid))*pp_commercial_samp)*((hrs_analyze_samp_op*rate_op)+cost_commercial_lab))*	Cost applies as written to NTNCWSs.	At or below AL	Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
I) Prepare and submit sample invalidation request to the State				
The number of samples expected to be invalid (calculated by multiplying the total number of required samples by the likelihood of invalidation) multiplied by the hours per sample and the system labor rate. *(numb_samp_customer*pp_samp_invalid)*(hrs_samp_invalid_op*rate_op*	Cost applies as written to NTNCWSs.	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
		Above AL	All model PWSs not doing POU sampling	Twice per year
The number of samples expected to be invalid (calculated by multiplying the total number of required samples by the likelihood of invalidation) multiplied by the hours per sample and the system labor rate. *(numb_reduced_tap*pp_samp_invalid)*(hrs_samp_invalid_op*rate_op)*	Cost applies as written to NTNCWSs.	At or below AL	Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90^{th} - Range	Other Conditions[2]	
m) Inform consumers of tap sample results				
The number of required of samples per system multiplied by the total of the hours per sample times the system labor rate plus the material cost per sample. *numb_samp_customer*((hrs_inform_samp_op*rate_op)+cost_cust_lt)*	Hours per sampling event multiplied by the system labor rate, plus the material cost per sampling event. *((hrs_ntncws_inform_samp_op*rate_op)+cost_ntncws_cust_lt)*	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
		Above AL	All model PWSs not doing POU sampling	Twice per year
The number of required samples per system multiplied by the total of the hours per sample times the system labor rate plus the material cost per sample. *numb_reduced_tap*((hrs_inform_samp_op*rate_op)+cost_cust_lt)*	Hours per sampling event multiplied by the system labor rate, plus the material cost per sampling event. *((hrs_ntncws_inform_samp_op*rate_op)+cost_ntncws_cust_lt)*	At or below AL	Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
n) Certify to State that results were reported to consumers				
			Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS: Lead 90th - Range	Conditions for Cost to Apply to a Model PWS: Other Conditions[2]	Frequency of Activity
Total hours per sampling event multiplied by the system labor rate. *(hrs_cert_cust_lt_op*rate_op)*	Cost applies as written to NTNCWSs.	At or below AL	Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			Model PWS on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		Above AL	All model PWSs not doing POU sampling	Twice per year
o) Submit request to renew 9-year monitoring waiver to the State[6]				
Total hours per sampling event multiplied by the system labor rate. *(hrs_renew_nine_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
p) Submit monitoring results and 90th percentile calculations to the State[5]				
Total hours per sampling event multiplied by the system labor rate. *(hrs_annual_lt_op*rate_op)*	Cost applies as written to NTNCWSs.	At or below AL	Model PWS not on reduced tap sampling and not doing POU sampling 1 - *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice per year
			Model PWS on annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			Model PWS on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
			Model PWS on nine-year reduced tap sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		Above AL	All model PWSs not doing POU sampling	Twice a year
q) Oversee the customer-initiated lead sampling program				
Total hours per probability per household a customer requests a sample multiplied by the system labor rate. *(hrs_cost_request_oversee_op*pp_customer_request*(pws_pop/numb_hh)*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
r) Ship tap sample monitoring materials and instructions to participating households for customer-initiated lead sampling program[5]				
Number of requested samples multiplied by the total of the hours per sample to provide instructions times the system labor rate, plus the cost of materials per sample. *pp_customer_request*(pws_pop/numb_hh)*((hrs_discuss_samp_op*rate_op)+cost_5_lt_samp)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
s) Collect lead tap samples for customer-initiated lead sampling program				
The number of requested samples per system multiplied by the hours per sample and the system labor rate. *pp_customer_request* pws_pop/numb_hh)*((hrs_pickup_samp_op*rate_op)+cost_pickup_samp)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
t) Analyze lead tap samples in-house or commercially for customer-initiated lead sampling program[5]				
The number of requested samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((pp_customer_request*(pws_pop/numb_hh)*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((pp_customer_request*(pws_pop/num*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
b_hh)*pp_commercial_samp)*((hrs_analyze_ _op*rate_op)+cost_5_commercial_lab))				
u) Inform customers of lead tap sample results for customer-initiated lead sampling program				
The number of requested of samples per system multiplied by the total of the hours per sample times the system labor rate plus the material cost per sample. (pp_customer_request* pws_pop/numb_hh))*((hrs_inform_samp_op*rate_op)+cost_cust_lt)	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year

Acronyms: AL = action level; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_hh*: the average number of people per household, which equals 2.53 (Section 4.3.5.1).
- *numb_reduced tap*: the number of lead tap samples for system on reduced annual, triennial, or 9-year monitoring (Section 4.3.2.1.1).
- *numb_samp_customer*: the number of lead tap samples for system on standard 6-month tap monitoring (Section 4.3.2.1.1).
- *p_tap_annual, p_tap_triennial*, and *p_tap_nine*: likelihood a systems is collecting the reduced number of lead tap samples on an annual, triennial, or 9-year frequency, respectively (Section 4.3.2.1.1).
- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] Does not apply to CWSs serving ≤ 3,300 people and all NTNCWSs that have selected POU as their compliance option if they exceeded the lead AL. See Section 4.3.5 for additional detail. PWSs with lead content or unknown lines are identified using the data variables and approach described in Chapter 3, Section 3.3.4.

[3] In Arkansas, Louisiana, Mississippi, Missouri, North Dakota, and South Carolina the State sends sampling instructions to the water systems and thus are assumed to incur the burden to update the sampling instruction in lieu of the system (ASDWA, 2020a).

[4] For modeling purposes, the EPA assumed that systems would report changes in sampling location during each monitoring period.

[5] The burden and costs to provide sample bottles (*cost_5_lt_samp*) under activity h), conduct analyses under activity k), and provide sampling results under activity p) are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina (ASDWA, 2020a).

[6] Only systems with 90th percentile values ≤ 5 µg/L can quality for a 9-year monitoring waiver.

4.3.2.1.3 Lead Tap Sampling PWS Unit Cost Estimation Example

This section provides examples of the estimation of the Lead Tap Sample Monitoring unit cost calculations for each activity a) through p) that are presented in Section 4.3.2.1.2 and Exhibit 4-16 and follows the same lettering system. These activities represent the routine lead tap monitoring requirements and do not include the customer-initiated sampling program requirements.

For this example, the EPA is using data that describe a surface water CWS with the following attributes:

- serves a population of 10,001 to 50,000;
- has LSLs in the distribution system;
- has CCT in place;
- is on a triennial Lead Tap Monitoring schedule;
- has a 90^{th} percentile at or below the AL; and
- is not conducing POU monitoring.

Model PWSs within the SafeWater LCR model are assigned either a 0 (no) or 1 (yes) for a number of system characteristics at the start of analysis, including LSL status. As described in Chapter 3, Section 3.3.4.1 (Exhibit 3-10), this model PWS has a 32.2 percent chance of having LSLs. As shown in Exhibit 4-4, the likelihood of this model PWS having a 90^{th} percentile initially at or below the AL under the final LCRI is 79 percent under the low cost scenario and 61.1 percent under the high cost scenario. Given that the model PWS has a 90^{th} percentile at or below the AL, the model PWS has a 98 percent likelihood of being on a triennial lead tap sample monitoring schedule (see Exhibit 3-39 in Chapter 3).

a) <u>Update Sampling Instructions and Submit to the State</u>

The model PWS would begin by updating their sampling instructions to reflect the requirements in the final LCRI. The estimation of this cost is represented by the following expression, which can be found in the first row under the heading "Update sampling instructions for lead tap sampling and submit to the State" in Exhibit 4-16:

Cost to update sampling instructions = *hrs_devel_samp_op* * *rate_op*

where:

- *hrs_devel_samp_op* is the number of hours a system will require to update sampling instructions (see Section 4.3.2.1.2, activity a)).
- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

Cost to update sampling instructions = (2 hrs * $42.68/hr) = $85.37

The model PWS will incur this $85.37 cost to update its sampling instructions in Year 4.

b) <u>Contact Homes to Establish a New 100 percent LSL Tap Sampling Pool</u>

Next, the example system would contact homes to establish a new 100 percent LSL tap sampling pool. The estimation of this cost is represented by the following expression:

Cost to contact homes = *hrs_add_lsl_samp_op* * *rate_op* (equation provided in Exhibit 4-16).

where:

- *hrs_add_lsl_samp_op* is the number of hours the system will require to contact homes with LSLs to achieve a 100 percent LSL sampling pool (see Exhibit 4-11).
- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

Cost to contact homes = (60 hrs * $42.68/hr) = $2,561.07.

The model PWS will incur this $2,561.07 cost to contact homes to establish a new sampling pool once within the first four years after promulgation.

c) <u>Update and Submit Tap Sampling Plan</u>

Next, the example system would update and submit their revised tap sampling plan to the State. The estimation of this cost is represented by the following expression:

Cost to submit tap sampling plan to the State = *hrs_samp_plan_op*rate_op*

where:

- *hrs_samp_plan_op* is the number of hours the system will require to update and submit their tap sampling plan to the State (see Section 4.3.2.1.2, activity c)).
- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

Cost to update and submit tap sampling plan to the State: (16 hrs * $42.68/hr) = $682.88

The model PWS will incur this $682.88 cost to update and submit their sampling plan to the State one time during Year 4.

d) <u>Report Changes in Sampling Location to the State</u>

Systems then report to the State on any changes in sampling location for lead tap sampling. The estimation of this cost is represented by the following expression:

Cost to report changes in sampling location = *hrs_chng_tap_op* * *rate_op*

where:

- *hrs_chng_tap_op* is the number of hours the system will require to report a change in tap locations to the State (see Section 4.3.2.1.2, activity d)).
- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

Cost to report changes in sampling location = (3 hrs * $42.68/hr) = $128.05

The model PWS will incur this $128.05 cost to report changes in sampling location once per sampling period, or every three years for this example system on triennial monitoring.

e) <u>Confer with the State on Initial Lead Monitoring Data and Status under LCRI</u>

Systems will confer with their States to discuss their requirements with the State based on their most recent two six-month monitoring periods.

Cost to confer with the State = *hrs_initial_tap_confer_op* * *rate_op*

where:

- *hrs_initial_tap_confer_op* is the number of hours the system will require to report a confer with the State on their initial monitoring data and status under the 2021 LCRR (see Section 4.3.2.1.2, activity e)).

- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

Cost to confer with the State = (2 hr * $42.68/hr) = $85.36

The model PWS will incur this $85.36 cost to confer with the State one-time during Year 4.

f) <u>Recruit Household Volunteers</u>

Systems also recruit household volunteers for the Lead Tap Sample Monitoring program for each round of sampling. The number of required samples is inflated to include those not collected, rejected, and invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. The estimation of this cost is represented by the following expression:

Cost to recruit household volunteers = [*numb_reduced_tap* + *numb_reduced tap* * (1 - *pp_hh_return_samp*) + *pp_samp_reject* + *pp_samp_invalid)*] * *hrs_samp_volunt_op* * *rate_op*

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (i.e., number of customers from whom a system must obtain samples for systems on reduced Lead Tap Sample Monitoring (see Exhibit 4-9)).

- 1 - *pp_hh_return_samp* is the likelihood that a volunteer household will not collect the sample for Lead Tap Sample Monitoring (see Section 4.3.2.1.2, activity f)).

- *pp_samp_reject* is the likelihood that a sample will be rejected by the system following lead tap sample monitoring but prior to sample analysis (see Section 4.3.2.1.2, activity f)).

- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid by the State (see Section 4.3.2.1.2, activity f)).

- *hrs_samp_volunt_op* is the number of hours per customer to obtain volunteer customers for Lead Tap Sample Monitoring samples (see Section 4.3.2.1.2, activity f)).

- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

Cost to recruit household volunteers = [30 samples + 30 samples * (1 - 0.9) + 0.05 + 0.006)] * (1 hr * $42.68/hr) = $1,480.30.

The model PWS will incur this $1,480.30 cost to recruit household volunteers once per sampling period, or in this example once every three years.

g) <u>Offer an Incentive to Households for Participation</u>

Systems that offer an incentive, do so to encourage participation in the lead tap sampling program. Seventy-five percent of systems are expected to offer an incentive. The number of households is assumed to equal the number of required samples. This number is not inflated by the number of samples rejected or deemed invalid because the EPA assumed that incentives are only provided to

customers that collect a sample that is not later rejected or invalidated. The estimation of this cost is represented by the following expression:

Cost to offer incentives = *numb_reduced_tap* * *cost_incentive*

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (i.e., number of customers from whom a system must obtain tap samples) for systems on reduced lead tap sample monitoring (see Exhibit 4-9).
- *cost_incentive* is the cost per customer for an incentive to participate in the sampling program (see Section 4.3.2.1.2, activity g)).

The variable *cost_incentive* ranges from $25 to $100 for the example PWS (see Section 4.3.2.1.2, activity g)). In the case of this example, the EPA assumed a value of $50.

Cost to offer incentives = (30 samples * $50/sample) = $1,500

The model PWS will incur this $1,500 cost to offer incentives once per sampling period, or in this example, once every three years.

h) <u>Ship Sample Material and Instructions</u>

Systems then ship the lead tap sampling sample materials and instructions to the participating households. The number of required samples is inflated to include those not collected, rejected, and invalidated to ensure that the cost reflects the additional burden that would occur to meet the sampling requirement. The estimation of this cost is represented by the following expression:

Cost to deliver sample material and instructions = [*numb_reduced_tap* + *numb_samp_customer* * (1 - *pp_hh_return_samp*) + *pp_samp_reject* + *pp_samp_invalid*)] * (*hrs_discuss_samp_op* * *rate_op* + *cost_5_lt_samp*)

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system for systems (*i.e.*, number of customers from whom a system must obtain tap samples) on reduced Lead Tap Sample Monitoring (see Exhibit 4-9).
- 1 - *pp_hh_return_samp* is the likelihood that a volunteer household will not collect the sample for Lead Tap Sample Monitoring (see Section 4.3.2.1.2, activity f)).
- *pp_samp_reject* is the likelihood that a sample will be rejected following lead tap sample monitoring (see Section 4.3.2.1.2, activity f)).
- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid (see Section 4.3.2.1.2, activity f)).
- *hrs_discuss_samp_op* is the number of hours per volunteer household to discuss and deliver Lead Tap Sample Monitoring sample instructions (see Section 4.3.2.1.2, activity h)).
- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

- *cost_5_lt_samp* is the material cost excluding consumables for in-house analyses for Lead Tap Sample Monitoring (i.e., test kit and shipping to customers, and cost to travel to pick-up bottles) (see Exhibit 4-12).

Cost to deliver sample material and instructions = [30 samples + 30 samples * ((1 - 0.9) + 0.05 + 0.006)] * ((0.25 hrs * $42.68/hr) + $8.96/sample) = $680.81

The model PWS will incur this $680.81 cost to ship materials and instructions once per sampling period, or in this example once every three years.

i) <u>Collect Lead Tap Samples</u>

Systems then pick up lead tap samples from the participating households. The number of required samples is inflated to include those rejected and invalidated to reflect the additional burden that must occur to meet the sampling requirement. The estimation of this cost is represented by the following expression:

Cost to pick up lead tap samples = [*numb_reduced_tap* + *numb_reduced_tap* * (*pp_samp_reject* + *pp_samp_invalid*)] * *((hrs_pickup_samp_op* * *rate_op) + cost_pickup_samp)*

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system for systems (i.e., number of customers from whom a system must obtain tap samples) on reduced Lead Tap Sample Monitoring (see Exhibit 4-9).
- 1 - *pp_hh_return_samp* is the estimated likelihood that a volunteer household will not collect the sample for Lead Tap Sample Monitoring (see Section 4.3.2.1.2, activity f)).
- *pp_samp_reject* is the likelihood that a sample will be rejected following Lead Tap Sample Monitoring (see Section 4.3.2.1.2, activity f)).
- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid (see Section 4.3.2.1.2, activity f)).
- *hrs_pickup_samp_op* is the number of hours per sample for PWS staff to travel to the customer's residence to pick up lead tap sample from customer (see Section 4.3.2.1.2, activity i)).
- *cost_pickup_samp* is the travel cost per sample for PWS to travel to the customer's residence to pick up lead tap sample from customer (see Section 4.3.2.1.2, activity i)).
- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

Cost to pick up lead tap samples = [30 samples + 30 samples * (0.05 + 0.006)] * ((0.4 hrs * $42.68/hr) + $5.75/sample) = $723.06.

The model PWS will incur this $723.06 cost to pick up lead tap samples once per sampling period, or in this example once every three years.

j) Determine if a Lead Tap Sample Should be Rejected

Systems must determine if a lead tap sample collected by a household should be rejected and not analyzed. The number of required samples is inflated to include those rejected and invalidated. The estimation of this cost is represented by the following expression:

Cost to determine if a lead tap sample should be rejected = [*numb_reduced_tap* + *numb_reduced_tap* * (*pp_samp_reject* + *pp_samp_invalid*)] * *hrs_samp_reject_op* * *rate_op*

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (i.e., number of customers from whom a system must obtain tap samples) for systems on reduced Lead Tap Sample Monitoring (see Exhibit 4-9).
- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid (see Section 4.3.2.1.2, activity f)).
- *pp_samp_reject* is the odds that a sample will be rejected following Lead Tap Sample Monitoring (see Section 4.3.2.1.2, activity f)).
- *hrs_samp_reject_op* is the number of hours per rejected sample for PWS staff to decide to reject sample (see Section 4.3.2.1.2, activity j)).
- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

Cost to determine if a lead tap sample should be rejected = [30 samples + 30 samples * (0.05 + 0.006)] * 0.25 hrs * $42.68/hr = $338.06

The model PWS will incur this $338.06 cost to determine if lead tap samples should be rejected once per sampling period, or in this example once every three years.

k) Analyze Lead Tap Samples

Systems then analyze the lead tap samples, either in-house or in a commercial laboratory. Systems serving populations of 10,001 to 50,000 are assumed to use commercial labs. The number of samples is inflated to include those invalidated, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. The estimation of this cost is represented by the following expression:

Cost to analyze lead tap samples = [*numb_reduced_tap* + *numb_reduced_tap* * *pp_samp_invalid*] * [(*pp_commercial_samp* * (*hrs_analyze_samp_op* * *rate_op* + *cost_lab_lt_samp*)) + (*pp_commercial_samp* * *cost_5_commercial_lab*)]

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (*i.e.*, number of customers from whom a system must obtain tap samples) for systems on reduced Lead Tap Sample Monitoring (see Exhibit 4-9).

- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid (see Section 4.3.2.1.2, activity f)).
- *pp_commercial_samp* is the likelihood that a sample will be analyzed in a commercial lab (see Section 4.3.2.1.2, activity k)).
- *hrs_analyze_samp_op* is the number of hours per sample it takes to analyze lead tap samples or source water monitoring results (see Section 4.3.2.1.2, activity k)).
- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).
- *cost_5_commercial_lab* is the commercial laboratory cost per sample (see Section 4.3.2.1.2, activity k)).

Cost to analyze lead tap samples = [30 samples + 30 samples * 0.006] * [(0 * (0 hrs * $0/sample + $0)) + (1 * $57.20/sample)] = $1,726.30

The model PWS will incur this $1,726.30 cost to analyze lead tap samples once per sampling period, or in this example once every three years.

l) Prepare and Submit Sample Invalidation Request to the State

The system must determine whether any of the samples may be invalid and submits the invalidation request to the State. The estimation of this cost is represented by the following expression:

Cost to prepare and submit sample invalidation request = *numb_reduced_tap* * *pp_samp_invalid* * *hrs_samp_invalid_op* * *rate_op*.

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system for systems (i.e., number of customers from whom a system must obtain tap samples) on reduced Lead Tap Sample Monitoring (see Exhibit 4-9).
- *pp_samp_invalid* is the likelihood that a lead sample will be deemed invalid (see Section 4.3.2.1.2, activity f)).
- *hrs_samp_invalid_op* is the number of hours per invalidated samples to submit sample invalidation request (see Section 4.3.2.1.2, activity l)).
- *rate_op* is the hourly rate for PWS staff (see Chapter 3, Section 3.3.11.1).

Cost to prepare and submit sample invalidation request = 30 samples * 0.006 * 2 hrs * 42.68/hrs = $15.37.

The model PWS will incur this $15.37 cost to prepare and submit a sample invalidation request once per sampling period, or in this example once every three years.

m) Inform Customers of Results

After the sampling, systems inform customers of results of the Lead Tap Sampling Monitoring collected at their household. The estimation of this cost is represented by the following expression:

Cost to inform customers of results = *numb_reduced_tap* * (*hrs_inform_samp_op* * *rate_op* + *cost_cust_lt*)

where:

- *numb_reduced_tap* is the number of reduced tap samples required per system (i.e., number of customers from whom a system must obtain tap samples) for systems on reduced Lead Tap Sample Monitoring (see Exhibit 4-9).
- *hrs_inform_samp_op* is the number of hours per sample to inform customers of lead results (see Section 4.3.2.1.2, activity m)).
- *rate_op* is the hourly rate for PWS staff (see Section 3.3.11.1).
- *cost_cust_lt* is the mailing cost per sample to inform customers of lead results (see Section 4.3.2.1.2, activity m)).

Cost to inform customers of results = 30 samples * (0.11 hrs * $42.68/hr + $0.72/sample) = $162.46

The model PWS will incur this $162.46 cost to inform customers of results once per sampling period, or in this example once every three years.

n) <u>Certify to the State that Results were Reported</u>

Systems then certify to the State that the Lead Tap Sample Monitoring results were reported to the customer. The estimation of this cost is represented by the following expression:

Cost to certify that results were reported = *hrs_cert_cust_lt_op* * *rate_op*

where:

- *hrs_cert_cust_lt_op* is the number of hours to certify to State that Lead Tap Sample Monitoring results were reported to customers (see Section 4.3.2.1.2, activity m)).
- *rate_op* is the hourly rate for PWS staff (see Section 3.3.11.1).

Cost to certify that results were reported = 0.66 hrs * $42.68/hr = $28.17

The model PWS will incur this $28.17 cost to certify that results were reported once per sampling period, or in this example once every three years.

o) <u>Submit Renewal of Nine-Year Monitoring Waiver Application</u>

Systems on nine-year sampling schedules would also be required to submit renewal of their nine-year monitoring waiver application, but this would not apply in the case of this example system because as discussed in Section 3.3.7.1, the EPA assumed only a subset of systems serving 1,000 or fewer would qualify for this waiver.

p) <u>Submit Monitoring Results and 90th Percentile Calculations to the State</u>

Finally, systems will submit their lead monitoring results and 90th percentile calculations to their State. The estimation of this cost is represented by the following expression:

Cost to draft and submit report on results = *hrs_annual_lt_op* * *rate_op*

where:

- *hrs_annual_lt_op* is the number of hours it takes to draft and report lead results and 90th percentile calculations (see Section 4.3.2.1.2, activity p)).
- *rate_op* is the hourly rate for PWS staff (see Section 3.3.11.1).

Cost to draft and submit report on results = 3.13 hrs * $42.68/hr = $133.59

The model PWS will incur this $133.59 cost to draft and submit a report on results once per sampling period or, in this example, once every three years.

<u>Total One-Time Costs and Per Sampling Period Costs</u>

The total one-time cost for the model PWS for activities a) through p) is $3,414.68 and the reoccurring cost that the PWS will incur once every three years is $6,916.17.

The lead tap water sampling costs of each model PWS in the SafeWater LCR model will vary depending on the characteristics of the model PWS. For example, if a model PWS with all of the attributes listed above had a 90th percentile above the AL, the model PWS sampling costs would be quite different. Instead of conducting one round of sampling every three years (i.e., triennial sampling), the model PWS would conduct sampling every six months. In addition, instead of taking 30 samples each sampling period, the model PWS will be required to take 60 samples each sampling period (see *numb_samp_customer* in Exhibit 4-9). Finally, the model PWS would conduct customer-initiated sampling.

4.3.2.2 PWS Lead Water Quality Parameter Monitoring

Lead WQP monitoring is required for all systems serving more than 10,000 people with CCT (except systems that meet the criteria in 40 CFR 141.81(b)(3) or “b3” systems) and those serving 50,000 or fewer people without CCT that exceed the lead AL of 10 µg/L. WQP samples are collected at representative sites throughout the distribution system (also referred to as tap samples) and at each entry point to the distribution system. Systems must conduct WQP monitoring prior to the installation of CCT and after CCT installation. The State may designate optimal water quality parameters (OWQPs) after the installation of CCT. Systems with CCT must continue to maintain WQPs at or above minimum values or within OWQP ranges designated by the State. Under the final LCRI, systems with CCT that have a single sample above 10 µg/L must conduct WQP monitoring in the distribution system at or near the site with the high result and determine if problems with CCT contributed to elevated lead. See 4.3.3.3 for a discussion of inputs related to this requirement.

The remainder of this section is divided into four subsections:

- 4.3.2.2.1: Baseline Corrosion Control Treatment
- 4.3.2.2.2: Initial Monitoring Schedules
- 4.3.2.2.3: Number of Samples

- 4.3.2.2.4: Lead WQP Monitoring Activities

Exhibit 4-37 at the end of Section 4.3.2.2 is a summary exhibit that explains how the cost inputs are modeled by the SafeWater LCR model.

4.3.2.2.1 Baseline Corrosion Control Treatment

WQP monitoring requirements vary for systems with and without CCT and by type of CCT. To estimate costs associated with WQP monitoring, the EPA identified systems with and without CCT, as described in Chapter 3, Section 3.3.3. For those with CCT, the EPA estimated the percentage of systems that currently have one of the three types of CCT used in the cost model:

- Modify pH (*pbaseph*),
- Add PO_4 without pH post-treatment (*pbasepo4*), and
- Add PO_4 and modify pH (*pbasephpo4*).

To develop these percentages, the EPA reviewed the treatment process codes reported for each system with a reported treatment objective code of "C" for corrosion control in the SDWIS/Fed fourth quarter 2020 frozen dataset. The EPA considered systems to:

- Have pH adjustment if they had a reported treatment process of: pH adjustment; pH adjustment, post; or pH adjustment, pre.
- Use a phosphate-based inhibitor if they had a reported treatment process of: inhibitor, polyphosphate; inhibitor, orthophosphate; inhibitor, bimetallic phosphate; or inhibitor, hexametaphosphate.
- Have both types of treatment if they had at least one of the treatment processes for both pH adjustment and phosphate-based inhibitor.
- Have only one of these treatments if they had one of the treatment processes for pH adjustment but none for a phosphate-based inhibitor or vice versa.

The results of this review are presented in Exhibit 4-17. Eighty-six percent of systems serving 3,300 or fewer people and 90 percent of systems serving more than 3,300 people reported a process code that indicated the use of pH adjustment and/or phosphate inhibitor.

Exhibit 4-17: Baseline Percentage of Systems Modifying pH and/or Adding PO_4

System Size (Population Served)	Add PO_4 and Modify pH	Modify pH	Add PO_4	Total
≤ 3,300	10%	46%	30%	86%
> 3,300	22%	36%	32%	90%

Since these percentage values will be used to assign CCT process type to systems already known to have CCT in place, the values in Exhibit 4-17 were normalized to represent the percent of systems with CCT using pH adjustment, phosphate inhibitor, or both phosphate inhibitor and pH adjustment. For example,

of the 86 percent of systems serving 3,300 or fewer people that reported a treatment process of phosphate and/or pH adjustment, 11 percent reported both a phosphate inhibitor and pH process code (10 percent/86 percent). These adjusted or normalized percentages are used in the cost model and are shown in Exhibit 4-18 below.

Exhibit 4-18: Normalized Baseline Percentage of Systems Modifying pH and/or Adding PO_4

System Size (Population Served)	Add PO_4 and Modify pH	Modify pH	Add PO_4	Total
	pbasephpo4	*pbaseph*	*pbasepo4*	
≤ 3,300	11%	54%	35%	100%
> 3,300	24%	40%	36%	100%

4.3.2.2.2 Initial Monitoring Schedules

As described in Section 3.3.8.2, systems with CCT can qualify for reduced WQP monitoring in the distribution system under the final LCRI if they are in compliance with State set OWQP ranges and do not exceed the final AL of 10 µg/L. The number of consecutive monitoring periods in which a system meets these criteria determines if a system will collect two samples at a reduced number of sites in the distribution system on a semi-annual or annually monitoring schedule. Under the LCRI, systems can no longer qualify for triennial WQP tap monitoring.

The EPA assumed only systems serving more than 10,000 people with CCT would qualify for reduced distribution system monitoring because these systems are required to continue WQP monitoring to demonstrate compliance with their OWQPs unlike smaller systems with CCT or systems without CCT. Section 3.3.8.2 in Chapter 3 also provides the EPA's approach for determining the estimated percentage of systems with CCT in each size category that would be on one of three WQP distribution monitoring schedules at the start of rule implementation based on historical SDWIS/Fed data. These percentages are provided in Chapter 3 in Exhibit 3-49 and Exhibit 3-50 for ground water and surface water CWSs with CCT, respectively and in Exhibit 3-51 and Exhibit 3-52 for ground water and surface water NTNCWSs with CCT, respectively.

4.3.2.2.3 Number of Samples

Exhibit 4-19 provides the minimum number of WQP distribution system samples for CWSs and NTNCWSs on standard and reduced monitoring. These are from the pre 2021 LCR, which have not been modified by the 2021 LCRR or the final LCRI with one exception. As discussed in Section 4.3.3.3.3, under the final LCRI, systems with a lead tap sample result above 10 µg/L must conduct WQP monitoring in the distribution system at or near the site with the high lead result. If an existing WQP site does not meet these criteria, the system must identify a new WQP monitoring site and those with CCT must use it for future sampling in addition to the existing number of WQP sites (*numb_enhance_wqp* or *numb_reduced_wqp*) shown in Exhibit 4-19. Refer to Section 4.3.3.3.3 for a more detailed discussion.

Exhibit 4-19: Minimum Number of WQP Distribution Samples for Systems on Standard or Reduced Monitoring

System Size (Population Served)	Standard Monitoring		Reduced Monitoring	
	Number of Sites	Number of Samples (2 per site)	Number of Sites	Number of Samples (2 per site)
		numb_enhance_wqp		*numb_reduced_wqp*
	A	**B = A*2**	**C**	**D = C*2**
≤500	1	2	1	2
501-3,300	2	4	2	4
3,301-10,000	3	6	3	6
10,001-100,000	10	20	7	14
>100,000	25	50	10	20

Notes: The required minimum number of WQP samples under the LCRI is the same as under the pre-2021 LCR and 2021 LCRR.

A&B: Specifies the number of samples collected in the distribution system for CWSs and NTNCWSs on standard monitoring during each 6-month period for systems serving > 10,000 people with CCT and systems serving ≤ 50,000 people without CCT during those monitoring periods in which they have a lead or copper ALE and each subsequent monitoring period until they no longer have an ALE for two consecutive monitoring periods. Systems must collect 2 samples per site and Column B reflects the input used in the cost model.

C&D: Specifies the reduced number of samples collected in the distribution system for CWSs and NTNCWSs on reduced monitoring for systems subject to WQP monitoring. Systems on reduced monitoring may be sampling on a 6-month or annual frequency. (See "WQP Schedules_CWS_LCRI_Final.xlsx" and "WQP Schedules_NTNCWS_LCRI_Final.xlsx" for initial WQP monitoring schedules.) Systems must collect 2 samples per site and Column D reflects the input used in the cost model.

Systems must also collect WQP samples at each entry point to the distribution system. The number of entry point samples, which corresponds to the SafeWater LCR model data input *numb_ep_wqp,* is as follows:

- Systems without CCT serving 50,000 or fewer people must collect 2 samples from each entry point to the distribution system during each 6-month monitoring periods following a lead or copper ALE. Under the LCRI, they must continue this monitoring until they no longer have an ALE during two consecutive 6-month monitoring periods.

- Systems with CCT must collect 1 sample per entry point every 2 weeks. This applies to all systems serving more than 50,000 except "b3" systems and those serving 10,001 to 50,000 people with CCT. It also applies to systems serving 10,000 or fewer people with CCT during each 6-month monitoring periods following a lead or copper ALE and subsequent monitoring periods until they no longer have an ALE for two consecutive monitoring periods.

There are no reduced monitoring provisions for WQPs collected at entry points, as was true under the pre-2021 LCR and 2021 LCRR.

The estimated number of entry points per system, which corresponds to the SafeWater LCR model input *numb_ep,* is provided in Chapter 3, Section 3.3.6.

4.3.2.2.4 Lead WQP Monitoring Activities

The EPA has developed water system costs for five lead WQP monitoring activities as shown in Exhibit 4-20. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden and costs follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-20: PWS Lead WQP Monitoring Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
v) Collect lead WQP samples from the distribution system	Burden per sample per PWS 0.5 hrs (distribution) Cost per sample No CCT: $2.66 (CWS & NTNCWS) pH adjustment: • $1.70 to $2.66 (CWS); • $2.66 (NTNCWS) Orthophosphate: • $2.66 to $2.82 (CWS) • $2.66 (NTNCWS)	Burden *hrs_wqp_op* Cost *No CCT: cost_wqp_material* *pH: cost_wqp_material_ph* *Orthophosphate:* *cost_wqp_material_ortho*
w) Analyze lead WQP samples from the distribution system	In-House Burden per sample No CCT: 0.15 hrs (CWS & NTNCWS) pH adjustment: • 0.15 to 0.46 hrs (CWS) • 0.15 hrs (NTNCWS) Orthophosphate: • 0.15 to 1.34 hrs (CWS) • 0.15 hrs (NTNCWS) In-House Cost per sample No CCT: $0.63 (CWS & NTNCWS) pH adjustment: • $0.63 to $0.98 (CWS) • $0.63 (NTNCWS) Orthophosphate: • $0.63 to $1.07 (CWS) • $0.63 (NTNCWS) Commercial Cost per sample No CCT: $27.24 to 30.55 (CWS & NTNCWS) pH adjustment: $27.24 to 30.55 (CWS & NTNCWS) Orthophosphate: $60.34 to $61.89 (CWS & NTNCWS)	In-House Burden *No CCT: hrs_wqp_analyze_dist_op* *pH: hrs_wqp_analyze_ph_op* *Orthophosphate:* *hrs_wqp_analyze_ortho_op* In-House Cost *No CCT: cost_wqp_analyze* *pH: cost_wqp_ph_analyze* *Orthophosphate:* *cost_wqp_ortho_analyze* Commercial Cost *No CCT: cost_lab_wqp* *pH: cost_lab_ph_wqp* *Orthophosphate:* *cost_lab_ortho_wqp*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
x) Collect lead WQP samples from entry points	Burden per sample 0.4 hrs for 80 percent of ground water PWSs[1] Cost per sample No CCT: $2.66 (CWS & NTNCWS) pH adjustment: • $1.70 to $2.66 (CWS); • $2.66 (NTNCWS) Orthophosphate: • $2.66 to $2.82 (CWS) • $2.66 (NTNCWS)	Burden *hrs_ep_wqp_op* Cost *cost_ep_wqp_material* *cost_ep_wqp_ph_material* *cost_ep_wqp_ortho_material*
y) Analyze lead WQP samples from entry points	In-House Burden per sample No CCT: 0.15 hrs (CWS & NTNCWS) pH adjustment: • 0.15 to 0.46 hrs (CWS) • 0.15 hrs (NTNCWS) Orthophosphate: • 0.15 to 1.34 hrs (CWS) • 0.15 hrs (NTNCWS) In-House Cost per sample No CCT: $0.63 (CWS & NTNCWS) pH adjustment: • $0.63 to $0.98 (CWS) • $0.63 (NTNCWS) Orthophosphate: • $0.63 to $1.07 (CWS) • $0.63 (NTNCWS) Commercial Cost per sample No CCT: • $29.28 to $30.21 (CWS) • No CCT: $30.55 (NTNCWS) pH adjustment: • $30.58 to $33.30 (CWS) • $33.93 (NTNCWS) Orthophosphate: • $61.90 to $63.49 (CWS) • $63.84 (NTNCWS)	In-House Burden *hrs_wqp_analyze_ep_op* *hrs_wqp_analyze_ph_ep_op* *hrs_wqp_analyze_ortho_ep_op* In-House Cost *cost_wqp_analyze_ep* *cost_wqp_analyze_ph_ep* *cost_wqp_analyze_ortho_ep* Commercial Cost *cost_lab_wqp_ep* *cost_lab_wqp_ph_ep* *cost_lab_wqp_ortho_ep*
z) Report lead WQP sampling data and compliance with OWQPs to the State	No CCT: 4 hrs/PWS With CCT: 5 hrs/PWS	Burden *hrs_report_wqp_op*

Acronyms: CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system; WQP = water qualify parameter.
Source: "WQP Analytical Burden and Costs_Final.xlsx."
Notes:

[1] The EPA assumed the burden to collect WQP samples to be 0.4 hours for all surface water systems and 20 percent of ground water systems based on the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 9 (WQP Monitoring - Monitoring, Burden, and Cost Assumptions) (USEPA, 2022a).

v) ***Collect lead WQP samples from the distribution system (hrs_wqp_op, cost_wqp_material, cost_wqp_material_ph, cost_wqp_material_ortho).*** Systems subject to lead WQP monitoring requirements must conduct WQP monitoring in the distribution system. The EPA assumed systems will incur a burden of 0.5 hours to collect each distribution WQP sample (*hrs_wqp_op*). This assumption is based on the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 9 (WQP Monitoring - Monitoring, Burden, and Cost Assumptions) (USEPA, 2022a).

Material costs for sample collection are for sample bottles. All systems subject to WQP requirements are assumed to conduct pH analyses in-house and for each sample will incur the cost for a 250-mL bottle in which the sample is collected. For systems using a commercial laboratory, all other bottle costs are included in the lab cost. Systems conducting in-house analysis of all WQPs (*i.e.*, CWSs serving more than 100,000 people) will incur additional bottle costs for other analytes.

Exhibit 4-21 and Exhibit 4-22 provides the materials cost associated with sample collection by CCT status and type for CWSs and NTNCWSs, respectively. The EPA's assumptions for each of these inputs are detailed in the exhibit notes.

Exhibit 4-21: CWS Material Costs Associated with Distribution System Sample Collection

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_material	*cost_wqp_material_ph*	*cost_wqp_material_ortho*
	A	B	C
≤50,000	$2.66	$2.66	$2.66
50,001-100,000	$0	$2.66	$2.66
> 100,000	$0	$1.70	$2.82

Acronyms: CCT = corrosion control treatment
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "Non-Labor Cost_CWS_LCRR_LCRI."
Notes:
General: All CWSs subject to WQP monitoring analyze pH in-house, so the likelihood CWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. CWSs serving 100,000 or fewer people are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters. The commercial laboratory cost includes sample bottles. CWSs serving more than 100,000 people are assumed to analyze all WQPs in-house. For these systems, *pp_lab_samp* is 100 percent and *pp_commercial_samp* is 0 percent.
A: Systems without CCT sample pH and alkalinity at entry points and within the distribution system. The EPA assumed no costs for systems serving > 50,000 people without CCT because they are b3 systems (16 in total) and are not subject to WQP requirements. Costs for systems serving ≤ 50,000 people is the cost of a 250-mL bottle in which the pH sample will be collected.
B: Systems using pH adjustment for CCT sample pH and alkalinity at entry points and within the distribution system. Costs for systems serving ≤ 100,000 people is the cost of a 250-mL bottle in which the pH sample is collected. The bottle for the alkalinity sample is included in the commercial lab cost. Costs for systems serving >

100,000 people is for one 500-ml bottle to collect a sample for pH and alkalinity together. These large systems are assumed to receive a discount on sample bottles because they buy in bulk.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate at entry points and within the distribution system. Costs for systems serving ≤ 100,000 people is the cost of a 250-mL bottle in which the pH sample will be collected, with all other bottles being provided by the commercial lab and included in the commercial lab cost. Costs for systems serving > 100,000 people is for: one 250-ml bottle for orthophosphate, and one 500-ml bottle to collect a sample for pH and alkalinity together. These large systems are assumed to receive a discount on sample bottles because they buy in bulk.

Exhibit 4-22: NTNCWS Material Costs Associated with Distribution System Sample Collection

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_material	*cost_wqp_material_ph*	*cost_wqp_material_ortho*
	A	B	C
≤50,000	$2.66	$2.66	$2.66
50,001-100,000	$0	$2.66	$2.66
100,001-1,000,000	$0	$2.66	$2.66
>1,000,000			

Acronyms: CCT = corrosion control treatment.
Source: File “WQP Analytical Burden and Costs_Final.xlsx,” worksheet “Non-Labor Cost_NTNCWS_LCRR_LCRI.”
Notes:
General: All NTNCWSs serving 50,001 to 1 million people are assumed to have CCT. No NTNCWS serves > 1 million people. All NTNCWSs subject to WQP monitoring analyze pH in-house, so the likelihood NTNCWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. All NTNCWSs are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters. The commercial laboratory cost includes sample bottles. Thus, the EPA assumed no NTNCWS would buy bottles in bulk.
A: Systems without CCT sample pH and alkalinity samples at entry points and within the distribution system. All NTNCWSs serving > 50,000 people are assumed to have CCT. Cost for systems serving ≤ 50,000 people is the cost of a 250-mL bottle in which the pH sample will be collected.
B: Systems using pH adjustment for CCT sample pH and alkalinity at entry points and within the distribution system. The cost is for a 250-mL bottle in which the pH sample will be collected. pH, alkalinity, and orthophosphate at entry points and within the distribution system. The cost is for a 250-mL bottle in which the pH sample will be collected. The EPA assumed no NTNCWS would buy bottles in bulk because with the exception of pH, all analyses are conducted by commercial laboratories who provide sample bottles as part of their services.

w) ***Analyze lead WQP samples from the distribution system.*** Systems will also incur burden and costs to analyze WQP samples collected in the distribution system. CWSs serving 100,000 or more people are assumed to analyze all samples in-house. All CWSs serving 100,000 or fewer people and all NTNCWSs are assumed to analyze pH in-house and to use a commercial laboratory to analyze other WQPs such as alkalinity or orthophosphate. Exhibit 4-23 and Exhibit 4-24 provide the analytical burden for CWSs and NTNCWSs to conduct in-house analyses, respectively. Exhibit 4-25 and Exhibit 4-26 provide the in-house analytical costs for CWSs and NTNCWSs, respectively. Lastly, Exhibit 4-27 and Exhibit 4-28 provide the commercial costs per sample for CWSs and NTNCWSs, respectively. Detailed assumptions are provided in the notes to each exhibit.

Exhibit 4-23: CWS In-House WQP Analytical Burden for Distribution System Samples (hrs/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	hrs_wqp_analyze_dist_op	*hrs_wqp_analyze_ph_op*	*hrs_wqp_analyze_ortho_op*
	A	B	C
≤50,000	0.15	0.15	0.15
50,001-100,000	0	0.15	0.15
>100,000	0	0.46	1.34

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "In-House_Burden_LCRR_LCRI."
Notes:
General: Burden estimates are the average of estimates provided by three laboratories. All CWSs subject to WQP monitoring will analyze pH in-house, so the likelihood CWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. CWSs serving 100,000 or fewer people are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters. CWSs serving more than 100,000 people are assumed to analyze all WQPs in-house. For these systems, *pp_lab_samp* is 100 percent and *pp_commercial_samp* is 0 percent.
A: Systems without CCT sample pH and alkalinity. Assumed no burden for systems serving > 50,000 people without CCT because they are b3 systems (16 in total) and not subject to WQP requirements. The burden estimate for systems serving ≤ 50,000 people is to analyze pH in-house.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The burden estimate for systems serving ≤ 100,000 people is to analyze pH in-house and for those serving > 100,000 people to analyze pH and alkalinity in-house.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The burden estimate for systems serving ≤ 100,000 of is to analyze pH in-house and for those serving > 100,000 people to analyze pH, alkalinity, and orthophosphate in-house.

Exhibit 4-24: NTNCWS In-House WQP Analytical Burden for Distribution System Samples (hrs/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	hrs_wqp_analyze_dist_op	*hrs_wqp_analyze_ph_op*	*hrs_wqp_analyze_ortho_op*
	A	B	C
≤50,000	0.15	0.15	0.15
50,001-100,000	0	0.15	0.15
100,001-1,000,000	0	0.15	0.15
>1,000,000			

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "In-House_Burden_LCRR_LCRI."
Notes:
General: All NTNCWSs serving 50,000 to 1 million people are assumed to have CCT; no NTNCWS serves > 1 million people. Burden is based on estimates from three laboratories. All NTNCWSs subject to WQP monitoring will analyze pH in-house, so the likelihood NTNCWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. All NTNCWSs are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters.

A: Systems without CCT sample pH and alkalinity. The EPA assumed no costs for systems serving > 50,000 people without CCT because all NTNCWSs are assumed to have CCT. The burden estimate for systems serving ≤ 50,000 is to analyze pH in-house.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The burden estimate is to analyze pH in-house.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The burden estimate for all NTNCWSs serving ≤ 50,000 is to analyze pH in-house.

Exhibit 4-25: CWS In-House WQP Analytical Cost for Distribution System Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_analyze	*cost_wqp_ph_analyze*	*cost_wqp_ortho_analyze*
	A	B	C
≤50,000	$0.63	$0.63	$0.63
50,001-100,000	$0	$0.63	$0.63
>100,000	$0	$0.98	$1.07

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "Non-Labor Cost_CWS_LCRR_LCRI."
Notes:
General: The exhibit presents in-house consumable costs for pH, alkalinity, and orthophosphate that are based on the average of three vendor quotes. All CWSs subject to WQP monitoring will analyze pH in-house, so the likelihood CWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. CWSs serving 100,000 or fewer people are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters. CWSs serving > 100,000 people are assumed to analyze all WQPs in-house. For these systems, *pp_lab_samp* is always 100 percent and *pp_commercial_samp* is always 0 percent.
A: Systems without CCT sample pH and alkalinity. Assumed no costs for systems serving > 50,000 people without CCT because they are b3 systems (16 in total) and not subject to WQP requirements.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The consumables cost for systems serving ≤ 100,000 is to analyze pH in-house and for those serving > 100,000 people is to analyze pH and alkalinity in-house.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The consumables cost for systems serving ≤ 100,000 people is to analyze pH in-house and for those serving > 100,000 people is to analyze pH, and alkalinity, and orthophosphate in-house.

Exhibit 4-26: NTNCWS In-House WQP Analytical Cost for Distribution System Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_analyze	*cost_wqp_ph_analyze*	*cost_wqp_ortho_analyze*
	A	B	C
≤50,000	$0.63	$0.63	$0.63
50,001-100,000	$0	$0.63	$0.63
100,001-1,000,000	$0	$0.63	$0.63
>1,000,000			

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx,"worksheet "Non-Labor Cost_NTNCWS_LCRR_LCRI."
Notes:
General: The exhibit presents in-house consumable costs for NTNCWSs that are based on the average of three vendor quotes. All NTNCWSs serving 50,000 to 1 million people are assumed to have CCT; no NTNCWS serves > 1

million people. All NTNCWSs subject to WQP monitoring will analyze pH in-house, so the likelihood NTNCWSs will conduct pH analyses in-house or *pp_lab_samp* is 100 percent. All NTNCWSs are assumed to use commercial laboratories to analyze other parameters for alkalinity and/or orthophosphate so the likelihood a system will use a commercial lab or *pp_commercial_samp* is 100 percent for these parameters.
A: Systems without CCT sample pH and alkalinity. The EPA assumed no costs for systems serving > 50,000 people without CCT because all NTNCWSs are assumed to have CCT. The consumables cost for systems serving ≤ 50,000 people is to analyze pH in-house.
B: Systems using pH adjustment sample pH and alkalinity. All system subject to WQP monitoring analyze pH in-house. The consumables cost for all NTNCWSs is to analyze pH in-house.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The consumables cost for all NTNCWSs is to analyze pH in-house.

Exhibit 4-27: CWS Commercial WQP Analytical Cost for Distribution System Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_lab_wqp	*cost_lab_ph_wqp*	*cost_lab_ortho_wqp*
	A	B	C
≤500	$30.55	$30.55	$61.89
501-3,300	$28.60	$28.60	$60.99
3,301-10,000	$27.96	$27.96	$60.74
10,001-50,000	$27.24	$27.24	$60.34
50,001-100,000	$0.00	$27.34	$60.45
>100,000	$0.00	$0.00	$0.00

Acronyms: CCT = corrosion control treatment.
Source: File “WQP Analytical Burden and Costs_Final.xlsx,” worksheet “Non-Labor Cost_CWS_LCRR_LCRI.”
Notes:
General: The exhibit presents commercial laboratory costs, based on quotes from seven laboratories, for alkalinity and orthophosphate including shipping the sample to the laboratory. CWSs serving ≤ 100,000 people will use commercial laboratories for these analyses. CWSs serving > 100,000 people are assumed to conduct all WQP analyses in-house and thus, will incur no commercial costs. All systems are assumed to conduct pH analyses in-house, which results in no commercial costs. Note that in general the costs decrease as the size of the water system increases. This is because larger water systems are sending more samples to the laboratory per shipment and thus incur a lower per shipping sample cost.
A: Systems without CCT sample pH and alkalinity. The EPA assumed no costs for systems serving > 50,000 people without CCT because they are b3 systems (16 in total) and not subject to WQP requirements. The commercial cost for systems serving ≤ 50,000 people is for alkalinity analyses of $26.43 based on the average of prices from seven laboratories plus shipping costs to the laboratory based on the weight of the number of filled samples. Refer to the source listed above for additional detail.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The commercial cost for systems serving ≤ 100,000 people is for alkalinity analyses and shipping the samples to the laboratory (see note A).
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The commercial cost for systems serving ≤ 100,000 is for alkalinity of $26.43 and orthophosphate analysis of $33.29 and shipping the samples to the laboratory (refer to the source above for additional detail).

Exhibit 4-28: NTNCWS Commercial WQP Analytical Cost for Distribution System Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_lab_wqp	*cost_lab_ph_wqp*	*cost_lab_ortho_wqp*
	A	B	C
≤500	$30.55	$30.55	$61.89
501-3,300	$28.60	$28.60	$60.99
3,301-10,000	$27.96	$27.96	$60.74
10,001-50,000	$27.24	$27.24	$60.34
50,001-100,000	$0.00	$27.34	$60.45
100,001-1,000,000	$0.00	$27.24	$60.34
>1,000,000			

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "Non-Labor Cost_NTNCWS_LCRR_LCRI."
Notes:
General: The exhibit presents commercial costs for alkalinity and orthophosphate. Alkalinity costs are based on the average of quotes from seven laboratories; those for orthophosphate are based on seven laboratory quotes. All NTNCWSs serving 50,000 to 1 million people are assumed to have CCT; no NTNCWS serves > 1 million people. All NTNCWSs are assumed to conduct pH analyses in-house and to use commercial laboratories for other analyses.
A: Systems without CCT will sample pH and alkalinity. The EPA assumed no costs for NTNCWSs serving > 50,000 people without CCT because all NTNCWSs are assumed to have CCT. All NTNCWSs are assumed to analyze pH in-house but to use commercial laboratories for all other analyses. Note that in general the costs decrease as the size of the water system increases. This is because larger water systems are sending more samples to the laboratory per shipment and thus incur a lower per shipping sample cost.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The commercial cost for NTNCWSs is for alkalinity analyses.
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The commercial cost for NTNCWSs is for alkalinity and orthophosphate analyses.

x) ***Collect lead WQP samples from entry points (hrs_ep_wqp_op, cost_ep_wqp_material, cost_ep_wqp_ph_material, cost_ep_wqp_ortho_material).*** Systems will also collect WQP samples at each entry point to the distribution system. The EPA assumed the burden to collect WQP samples (*hrs_ep_wqp_op*) to be:

- 0 hours for all surface water systems and 20 percent of ground water systems because they are already collecting entry point samples to comply with other drinking water regulations.
- 0.4 hours for the remaining 80 percent of ground water systems.

These estimates are based on the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal),* Exhibit 9 (WQP Monitoring - Monitoring, Burden, and Cost Assumptions) (USEPA, 2022a).

The EPA assumed that systems will analyze for the same WQPs in entry points samples as distribution samples and incur the same material costs (*i.e.*, bottle costs) as detailed in activity v). Even though burden and costs inputs are identical, the EPA used different data variable names for entry point samples for modeling flexibility in the SafeWater LCR model. The input values and

corresponding data variable IDs for entry point samples are provided in Exhibit 4-29 and Exhibit 4-30 for CWSs and NTNCWSs, respectively.

Exhibit 4-29: CWS Material Costs Associated with Entry Point Sample Collection

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_ep_wqp_material	*cost_ep_wqp_ph_material*	*cost_ep_wqp_ortho_material*
	A	B	C
≤50,000	$2.66	$2.66	$2.66
50,001-100,000	$0	$2.66	$2.66
>100,000	$0	$1.70	$2.82

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "Non-Labor Cost_CWS_LCRR_LCRI."
Notes: The input values in this exhibit are identical to Exhibit 4-21. Refer to the exhibit notes for Exhibit 4-21 for detailed assumptions.

Exhibit 4-30: NTNCWS Material Costs Associated with Entry Point Sample Collection

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_ep_wqp_material	*cost_ep_wqp_ph_material*	*cost_ep_wqp_ortho_material*
	A	B	C
≤50,000	$2.66	$2.66	$2.66
50,001-100,000	$0	$2.66	$2.66
100,001-1,000,000	$0	$2.66	$2.66
>1,000,000			

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "Non-Labor Cost_NTNCWS_LCRR_LCRI."
Notes: The input values in this exhibit are identical to Exhibit 4-22. Refer to the exhibit notes for Exhibit 4-22 for detailed assumptions.

y) Analyze lead WQP samples from entry points. Systems are required to analyze the same WQPs in entry points samples as distribution system samples and incur the same in-house burden and material (*i.e.*, bottle) cost as detailed in activity w). They will also have the same commercial costs but different shipping costs due to differences in the number of entry point samples being shipped for analysis compared to the number of distribution system samples. The input values with corresponding SafeWater LCR model entry point data variables are provided in the following exhibits:

- Exhibit 4-31 and Exhibit 4-32 for CWS and NTNCWS in-house analytical burden, respectively,
- Exhibit 4-33 and Exhibit 4-34 for CWS and NTNCWS in-house analytical cost, respectively, and
- Exhibit 4-35 and Exhibit 4-36 for CWSs and NTNCWS commercial analyses, respectively.

Exhibit 4-31: CWS In-House WQP Analytical Burden for Entry Point Samples (hrs/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	hrs_wqp_analyze_ep_op	*hrs_wqp_analyze_ph_ep_op*	*hrs_wqp_analyze_ortho_op*
	A	B	C
≤50,000	0.15	0.15	0.15
50,001-100,000	0	0.15	0.15
>100,000	0	0.46	1.34

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "In-House_Burden_LCRR_LCRI."
Notes: The input values in this exhibit are identical to Exhibit 4-23. Refer to the exhibit notes for Exhibit 4-23 for detailed assumptions.

Exhibit 4-32: NTNCWS In-House WQP Analytical Burden for Entry Point Samples (hrs/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	hrs_wqp_analyze_ep_op	*hrs_wqp_analyze_ph_ep_op*	*hrs_wqp_analyze_ortho_op*
	A	B	C
≤50,000	0.15	0.15	0.15
50,001-100,000	0	0.15	0.15
100,001-1,000,000	0	0.15	0.15
>1,000,000			

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "In-House_Burden_LCRR_LCRI."
Notes: The input values in this exhibit are identical to Exhibit 4-24. Refer to the exhibit notes for Exhibit 4-24 for detailed assumptions.

Exhibit 4-33: CWS In-House WQP Analytical Cost for Entry Point Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_analyze_ep	*cost_wqp_analyze_ph_ep*	*cost_wqp_analyze_ortho_ep*
	A	B	C
≤50,000	$0.63	$0.63	$0.63
50,001-1,000,000	$0	$0.63	$0.63
>1,000,000	$0	$0.98	$1.07

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet, "Non-Labor Cost_NTNCWS_LCRR_LCRI."
Notes: The input values in this exhibit are identical to Exhibit 4-25. Refer to the exhibit notes for Exhibit 4-25 for detailed assumptions.

Exhibit 4-34: NTNCWS In-House WQP Analytical Cost for Entry Point Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_wqp_analyze_ep	cost_wqp_analyze_ph_ep	cost_wqp_analyze_ortho_ep
	A	B	C
≤50,000	$0.63	$0.63	$0.63
50,001-100,000	$0	$0.63	$0.63
100,001-1,000,000	$0	$0.63	$0.63
>1,000,000			

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "Non-Labor Cost_NTNCWS_LCRR_LCRI."
Notes: The input values in this exhibit are identical to Exhibit 4-26. Refer to the exhibit notes for Exhibit 4-26 for detailed assumptions.

Exhibit 4-35: CWS Commercial WQP Analytical Cost for Entry Point Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_lab_wqp_ep	cost_lab_wqp_ph_ep	cost_lab_wqp_ortho_ep
	A	B	C
≤100	$30.21	$33.30	$63.49
101-500	$29.95	$32.82	$63.23
501-1,000	$29.39	$32.82	$62.68
1,001-3,300	$29.49	$32.00	$62.78
3,301-10,000	$29.52	$32.61	$62.98
10,001-50,000	$29.28	$31.84	$62.56
≤50,000	$0	$30.58	$61.90
50,001-100,000	$0	$0	$0
>100,000	$0	$0	$0

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "Non-Labor Cost_CWS_LCRR_LCRI."
Notes:
General: The exhibit presents commercial laboratory costs, based on quotes from seven laboratories, for alkalinity and orthophosphate including shipping the sample to the laboratory. CWSs serving ≤ 100,000 people will use commercial laboratories for these analyses. CWSs serving > 100,000 people are assumed to conduct all WQP analyses in-house and thus, will incur no commercial costs. All systems are assumed to conduct pH analyses in-house, which results in no commercial costs. Note that in general the costs decrease as the size of the water system increases. This is because larger water systems are sending more samples to the laboratory per shipment and thus incur a lower per shipping sample cost.
A: Systems without CCT sample pH and alkalinity. The EPA assumed no costs for systems serving > 50,000 people without CCT because they are b3 systems (16 in total) and not subject to WQP requirements. The commercial cost for systems serving ≤ 50,000 people is for alkalinity analyses of $26.43 based on the average of prices from seven laboratories plus shipping costs to the laboratory based on the weight of the number of filled samples. Refer to the source listed above for additional detail.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The commercial cost for systems serving ≤ 100,000 people is for alkalinity analyses and shipping the samples to the laboratory (see note A).
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The commercial cost for systems serving ≤ 100,000 is for alkalinity of $26.43 and orthophosphate analysis of $33.29 and shipping the samples to the laboratory (refer to the source above for additional detail).

Exhibit 4-36: NTNCWS Commercial WQP Analytical Cost for Entry Point Samples ($/sample)

System Size (Population Served)	Without CCT	With pH Adjustment	With Orthophosphate
	cost_lab_wqp_ep	*cost_lab_wqp_ph_ep*	*cost_lab_wqp_ortho_ep*
	A	B	C
≤50,000	$30.55	$33.93	$63.84
50,001-100,000	$0	$33.93	$63.84
100,001-1,000,000	$0	$0	$0
>1,000,000			

Acronyms: CCT = corrosion control treatment.
Source: File "WQP Analytical Burden and Costs_Final.xlsx," worksheet "Non-Labor Cost_NTNCWS_LCRR_LCRI."
Notes:
General: No NTNCWS serves > 1 million people. The exhibit presents commercial laboratory costs, based on quotes from seven laboratories, for alkalinity and orthophosphate including shipping the sample to the laboratory. All NTNCWSs are assumed to use commercial laboratories for these analyses.
A: Systems without CCT sample pH and alkalinity. All NTNCWSs serving 50,000 to 1 million people are assumed to have CCT. The commercial cost for systems serving ≤ 50,000 people is for alkalinity analyses of $26.43 based on the average of prices from seven laboratories plus shipping costs to the laboratory based on the weight of the number of filled samples. Refer to the source listed above for additional detail.
B: Systems using pH adjustment for CCT sample pH and alkalinity. The commercial cost for systems serving ≤ 100,000 people is for alkalinity analyses and shipping the samples to the laboratory (see note A).
C: Systems using orthophosphate treatment sample pH, alkalinity, and orthophosphate. The commercial cost for systems serving ≤ 100,000 is for alkalinity of $26.43 and orthophosphate analysis of $33.29 and shipping the samples to the laboratory. Refer to the source listed above for additional detail.

z) ***Report lead WQP sampling data and compliance with OWQPs to the State (hrs_report_wqp_op).*** Systems are required to report their WQP results and for those systems where OWQPs have been set to demonstrate compliance with those OWQPs every six months. The EPA estimated systems with CCT and without CCT would require 5 hours and 4 hours, respectively. The estimated reporting burden for systems with CCT is based on the WQP Reporting (Annual) burden in Exhibit 9 of the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (USEPA, 2022a). The EPA assumed systems without CCT would incur a lower burden because they would be reporting less entry point monitoring data than those with CCT that must conduct entry point monitoring biweekly. These systems without CCT are also not determining compliance with OWQPs.

Exhibit 4-37 shows the SafeWater LCR model cost estimation approach for water system lead WQP monitoring activities including additional cost inputs that are required to calculate these costs.

Exhibit 4-37: PWS Lead WQP Monitoring Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90^{th} - Range	Other Conditions	
v) Collect lead WQP samples from the distribution system				
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material))*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice per year
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ph))*			Model PWSs serving ≤10,000 with pH adjustment *pbaseph*	
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ortho))*			Model PWSs serving ≤10,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ph))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving >10,000 with pH adjustment that do not qualify for reduced WQP monitoring	Twice per year
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ortho))*			Model PWSs serving >10,000 with PO_4 or both PO_4 and pH adjustment that do not qualify for reduced WQP monitoring *pbasepo4, pbasephpo4,* 1 – *(p_wqp_annual + p_wqp_six_red)*	Twice per year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. (numb_reduced_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ph))	Cost applies as written to NTNCWSs.	All	Model PWSs serving >10,000 with pH adjustment on six-month reduced WQP monitoring *pbaseph, p_wqp_six_red*	Twice a year
			Model PWSs serving >10,000 with pH adjustment on annual WQP monitoring *pbaseph, p_wqp_annual*	Once a year
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_reduced_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ortho))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving >10,000 with PO_4 or both PO_4 and pH adjustment on six-month reduced sample WQP monitoring *pbasepo4, pbasephpo4, p_wqp_six_red*	Twice a year
			Model PWSs serving >10,000 with PO_4 or both PO_4 and pH adjustment on annual WQP monitoring *pbasepo4, pbasephpo4, p_wqp_annual*	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
w) Analyze lead WQP samples from the distribution system				
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_dist_op*rate_op)+cost_wqp_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_wqp))*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice a year
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ph_wqp))*			Model PWSs serving ≤10,000 with pH adjustment *pbaseph*	
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample.			Model PWSs serving ≤10,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
*(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ortho_wqp))*				
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ph_wqp))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving >10,000 with pH adjustment that do not qualify for reduced WQP monitoring *pbaseph;* 1- *(p_wqp_annual + p_wqp_six_red)*	Twice a year
There are different labor (burden) and material costs for a sample analyzed in house and a sample analyzed using a commercial lab. The in-house analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in house times the system labor rate, plus the material cost of the in-house analysis per sample. The commercial lab analysis costs are calculated using the number of required samples per system multiplied by the percentage of samples analyzed in a commercial lab times the system labor rate, plus the material cost of the commercial lab analysis per sample. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ortho_wqp))*			Model PWSs serving >10,000 with PO_4 or both PO_4 and pH adjustment that do not qualify for reduced WQP monitoring *pbasepo4; pbasephpo4;* 1 – *(p_wqp_annual + p_wqp_six_red)*	Twice a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. (((numb_reduced_wqp*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_reduced_wqp*pp_commercial_samp)*cost_lab_ph_wqp))	Cost applies as written to NTNCWSs.	All	Model PWSs serving >10,000 with pH adjustment on six-month reduced sample WQP monitoring *pbaseph, p_wqp_six_red*	Twice a year
			Model PWSs serving >10,000 with pH adjustment on annual WQP monitoring *pbaseph, p_wqp_annual*	Once a year
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_reduced_wqp*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_reduced_wqp*pp_commercial_samp)*cost_lab_ortho_wqp))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving > 10,000 with PO_4 or both PO_4 and pH adjustment on six-month reduced WQP monitoring *pbasepo4, pbasephpo4, p_wqp_six_red*	Twice a year
			Model PWSs serving > 10,000 with PO_4 or both PO_4 and pH adjustment on annual WQP monitoring *pbasepo4, pbasephpo4, p_wqp_annual*	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
x) Collect lead WQP samples from entry points				
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_material))*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice a year
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ph_material))*			Model PWSs serving ≤10,000 with pH adjustment *pbaseph*	Every 2 weeks
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ortho_material))*			Model PWSs serving ≤10,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ph_material))*	Cost applies as written to NTNCWSs.	All	Model PWSs serving > 10,000 with pH adjustment *pbaseph*	Every 2 weeks
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ortho_material))*			Model PWSs serving > 10,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
y) Analyze lead WQP entry point samples				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. ((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ep_op*rate_op)+cost_wqp_analyze_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)* cost_lab_wqp_ep))	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice a year
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. ((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ph_ep_op*rate_op)+cost_wqp_analyze_ph_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ph_ep))	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤10,000 with pH adjustment pbaseph	Every two weeks
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. ((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ortho_ep_op*rate_op)+cost_wqp_analyze_ortho_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ortho_ep))		Above AL	Model PWSs serving ≤10,000 with PO_4 or both PO_4 and pH adjustment pbasepo4, pbasephpo4	
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. ((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ph_ep_op*rate_op)+cost_wqp_analyze_ph_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ph_ep))	Cost applies as written to NTNCWSs.	All	Model PWSs serving >10,000 with pH adjustment pbaseph	Every two weeks
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. ((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_analyze_ortho_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ortho_ep))			Model PWSs serving >10,000 with PO_4 or both PO_4 and pH adjustment pbasepo4, pbasephpo4	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
z) Report lead WQP sampling data and compliance with OWQPs to the State				
The labor hours for reporting per system multiplied by the labor rate. *(hrs_report_wqp_op*rate_op)*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs serving ≤50,000 without CCT	Twice a year
			Model PWSs serving ≤10,000 with pH adjustment *pbaseph*	
			Model PWSs serving ≤10,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	
		All	Model PWSs serving >10,000 with pH adjustment *pbaseph*	
			Model PWSs serving >10,000 with PO_4 or both PO_4 and pH adjustment *pbasepo4, pbasephpo4*	

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; OWQP = optimal water quality parameter; PO_4 = orthophosphate; PWS = public water system; WQP = water quality parameter.

Note:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_enhance_wqp*: number of distribution system samples for systems on standard WQP monitoring (Section 4.3.2.2.3).
- *numb_ep*: number of entry points per systems (Section 4.3.2.2.3).
- *numb_reduced_wqp*: number of distribution system samples for systems on reduced WQP monitoring (Section 4.3.2.2.3).
- *pbaseph*: likelihood a system has an existing CCT of modify pH (Section 4.3.2.2.1).
- *pbasepo4*: likelihood a system has existing CCT of adding PO_4 without pH post treatment (Section 4.3.2.2.1).
- *pbasephpo4*: likelihood a system has existing CCT of adding PO_4 with modify pH (Section 4.3.2.2.1).
- *p_wqp_six_red, p_wqp_annual*: likelihood a system is on reduced distribution system monitoring schedule at a semi-annual or annual schedule, respectively (Section 4.3.2.2.2).
- *rate_op*: PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

4.3.2.3 PWS Copper Water Quality Parameter Monitoring

This discussion of copper WQP monitoring costs for water systems is presented in the following subsections:

- 4.3.2.3.1: Applicability and Likelihood of a Copper ALE
- 4.3.2.3.2: Copper WQP Monitoring Activities

4.3.2.3.1 Applicability and Likelihood of a Copper ALE

The SafeWater LCR models Copper WQP Monitoring separately from the Lead WQP Monitoring. The frequency of Lead WQP Monitoring depends on the lead 90th percentile, with all systems above the AL and all systems serving more than 10,000 people with CCT, and those serving more than 50,000 people without CCT[105] conducting Lead WQP Monitoring. Copper WQP Monitoring is required when a system exceeds the copper AL. To not double count the cost of WQP monitoring for systems experiencing both a copper ALE and a lead ALE simultaneously, the SafeWater LCR models the costs of Copper and Lead WQP Monitoring separately and restricts Copper WQP Monitoring to systems with a copper ALE only and lead 90th percentile not greater than the lead AL.

Note that the cost inputs used to estimate WQP costs in response to a copper ALE are identical to those incurred in response to a lead ALE with the following exceptions:

- The likelihood of a system exceeding the copper AL only, which corresponds to *p_copper_ale,* is used in lieu of a system's lead 90th percentile level.
- Systems are not assumed to be on reduced WQP distribution system monitoring in response to a copper ALE, and all systems are assumed to be on a 6-month standard monitoring schedule. Thus, the data inputs associated with reduced monitoring are not applicable. These include the reduced number of WQP monitoring samples per distribution sample site (*numb_reduced_wqp*), and the likelihood that a system will be on a 6-month *(p_wqp_six_red)* or annual *(p_wqp_annual)* WQP sampling schedule.

Exhibit 4-38 and Exhibit 4-39 provide the likelihood that a CWS and NTNCWS, respectively, will exceed the copper AL of 1.3 mg/L, but not the final lead AL of 10 µg/L (*p_copper_ale*). In each exhibit, the estimated percentages are provided for each of the 9 size categories and two source water types used in the cost model. For systems without CCT, the EPA derived the percentages from SDWIS/Fed 90th percentile results from 2012 – 2020[106] as follows:

[105] All systems serving more than 50,000 people are required to have CCT and to conduct WQP monitoring with the exception of systems that have naturally non-corrosive water, i.e., "b3" systems. Refer to Chapter 3, Section 3.3.3 for the EPA's approach for deriving the number of "b3" systems (assumed to be 16 CWSs).

[106] The EPA expanded the analysis period from the proposed LCRI EA (USEPA, 2023c) of 2017 – 2020 to be more consistent with other analyses that use a nine-year analysis period.

- Step 1: For each year during 2012 – 2020, the EPA identified the number of CWSs with a reported copper 90th percentile value above the copper AL and no reported lead 90th percentile above the AL[107] for the nine size categories and two source types.

- Step 2: The EPA divided the number of systems in step 1 by the number of CWSs in each size and source strata to develop a percentage. Each percentage was divided by 100 to derive the likelihood.

The EPA used the same approach to develop the estimated percent of NTNCWSs with independent copper ALEs. Chapter 3, Exhibit 3-34 and Exhibit 3-35 provide the results of this analysis for CWSs and NTNCWSs, respectively. Note that for modeling purposes, the EPA assumed that no system with CCT would have a copper ALE and thus, would have a likelihood of 0 percent. The EPA made this simplifying assumption because only approximately 1 percent of CWSs and approximately 3 percent of NTNCWSs with CCT were estimated to have a copper only ALE. Exhibit 4-38 and Exhibit 4-39 provide the likelihoods used in the SafeWater LCR model for the data variable *p_copper_ale*. As shown in these exhibits, no CWS or NTNCWS serving more than 50,000 people is assumed to have a copper only ALE and be subject to copper WQP monitoring. However, as discussed in Section 4.3.2.2, these systems are assumed to conduct lead WQP monitoring with the exception of those designated as "b3" systems.

Exhibit 4-38: Estimated Likelihood a CWS Will Have a Copper Only ALE (2012 – 2020)

System Size (Population Served)	*p_copper_ale*			
	with CCT[1]		without CCT[2]	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	0.000	0.000	0.003	0.010
101–500	0.000	0.000	0.004	0.007
501–1,000	0.000	0.000	0.004	0.006
1,001–3,300	0.000	0.000	0.005	0.003
3,301–10,000	0.000	0.000	0.003	0.002
10,001–50,000	0.000	0.000	0.001	0.001
50,001–100,000	0.000	0.000	0.000	0.000
100,001–1,000,000	0.000	0.000	0.000	0.000
>1,000,000	0.000	0.000		

Acronyms: CCT = corrosion control treatment.
Source:
SDWIS/Fed fourth quarter frozen data set, current through December 31, 2020. Also see "CWS Inventory Characteristics_Final.xlsx" for additional detail.

[107] As noted in Chapter 3, Section 3.3.5.4 that details this analysis, the EPA did not adjust the lead 90th percentile values to consider the change in the sampling protocol for systems with LSLs. Nor did the EPA account for the proposed LCRI's lower lead AL of 10 µg/L. Thus, the EPA's approach will likely overestimate the percentage of systems having a copper only ALE because more of these systems may also have a lead ALE under the proposed LCRI compared to under the 2021 LCRR.

Notes:
General: The EPA estimated that 16 CWSs are b3 systems, serve 50,001 – 1 million people, and have no CCT. No b3 systems serve more than 1 million people and is indicated using gray shading.
[1] Note that for modeling purposes, the EPA assumed that no system with CCT would have a copper ALE and thus, would have a likelihood of 0 percent.
[2] For each year during 2012 - 2020, the EPA identified the number of CWSs with a reported copper 90th percentile value above the copper AL and no reported lead 90th percentile values above the AL for the 9 size categories and two source types. The EPA then divided the number of systems by the number of CWSs in each size and source strata to develop a percentage. Each percentage was divided by 100 to derive the likelihood. Note that all systems serving > 50,000 people without CCT (16 systems) are categorized as “b3” systems and have no copper ALEs (see Section 3.3.3 in Chapter 3 for additional detail).

Exhibit 4-39: Estimated Likelihood a NTNCWS Will Have a Copper Only ALE (2012 – 2020)

System Size (Population Served)	*p_copper_ale*			
	with CCT[1]		without CCT[2]	
	Ground Water	Surface Water	Ground Water	Surface Water
≤100	0.000	0.000	0.006	0.003
101–500	0.000	0.000	0.006	0.012
501–1,000	0.000	0.000	0.006	0.012
1,001–3,300	0.000	0.000	0.008	0.017
3,301–10,000	0.000	0.000	0.001	0.007
10,001–50,000	0.000	0.000	0.015	0.007
50,001–100,000		0.000		
100,001–1,000,000		0.000		
>1,000,000				

Acronyms: CCT = corrosion control treatment.
Source:
SDWIS/Fed fourth quarter frozen data set, current through December 31, 2020. Also see “NTNCWS Inventory Characteristics_Final.xlsx” for additional detail.
Notes:
General: Two NTNCWSs serve 50,001 – 1 million people and each have CCT. No NTNCWS serves > 1 million people.
[1] Note that for modeling purposes, the EPA assumed that no system with CCT would have a copper ALE and thus, would have a likelihood of 0 percent.
[2] For each year during 2012 - 2020, the EPA identified the number of NTNCWSs with a reported copper 90th percentile value above the copper AL and no reported lead 90th percentile values above the AL for the 9 size categories and two source types. The EPA then divided the number of systems by the number of NTNCWSs in each size and source strata to develop a percentage. Each percentage was divided by 100 to derive the likelihood.

4.3.2.3.2 Copper WQP Monitoring Activities

The activities, unit burden and costs, and data variables used to estimate copper WQP monitoring costs are identical to those for lead, as shown in Exhibit 4-40, with the exception that they are triggered in response to a copper ALE.

Exhibit 4-40: PWS Copper WQP Monitoring Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
aa) Collect copper WQP samples from the distribution system	*Same as Exhibit 4-20, activity v).*	
bb) Analyze copper WQP samples from the distribution system	*Same as Exhibit 4-20, activity w).*	
cc) Collect copper WQP samples from entry points	*Same as Exhibit 4-20, activity x).*	
dd) Analyze copper WQP samples from entry points	*Same as Exhibit 4-20, activity y).*	
ee) Report copper WQP sampling data and compliance with OWQPs to the State	*Same as Exhibit 4-20, activity z).*	

Acronyms: ALE = action level exceedance; OWQP = optimal water qualify parameter; WQP = water qualify parameter.
Source: "WQP Analytica Burden and Costs_Final.xlsx."

Exhibit 4-41 shows the SafeWater LCR model cost estimation approach for system WQP monitoring activities in response to a copper ALE including additional cost inputs that are required to calculate these costs.

Exhibit 4-41: PWS Copper WQP Monitoring Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
aa) Collect copper WQP samples in the distribution system				
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material))*	Cost applies as written to NTNCWSs.	At or below AL	Model PWSs serving ≤50,000 without CCT and have a copper ALE *p_copper_ale*	Twice per event
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ph))*			Model PWSs serving ≤10,000 that have pH adjustment and a copper ALE *p_copper_ale, pbaseph*	
Number of samples multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(numb_enhance_wqp*((hrs_wqp_op*rate_op)+cost_wqp_material_ortho))*			Model PWSs serving ≤10,000 that have PO_4 or both PO_4 and pH adjustment and a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
bb) Analyze copper WQP samples from the distribution system				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_dist_op*rate_op)+cost_wqp_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_wqp))*	Cost applies as written to NTNCWSs.	At or below AL	Model PWSs serving ≤50,000 without CCT and have a copper ALE *p_copper_ale*	Twice per event
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ph_wqp))*			Model PWSs serving ≤10,000 that have pH adjustment and a copper ALE *p_copper_ale, pbaseph*	
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_enhance_wqp*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_enhance_wqp*pp_commercial_samp)*cost_lab_ortho_wqp))*			Model PWSs serving ≤10,000 that have PO_4 or both PO_4 and pH adjustment and have a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
cc) Collect copper WQP samples from entry points				
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_material))*	Cost applies as written to NTNCWSs.	At or below AL	Model PWSs serving ≤50,000 without CCT and have a copper ALE *p_copper_ale*	Every 2 weeks per event
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ph_material))*			Model PWSs serving ≤10,000 that have pH adjustment and a copper ALE *p_copper_ale, pbaseph*	
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_ep_wqp)*((hrs_ep_wqp_op*rate_op)+cost_ep_wqp_ortho_material))*			Model PWSs serving ≤10,000 that have PO_4 or both PO_4 and pH adjustment and have a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
dd) Analyze copper WQP samples from entry points				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ep_op*rate_op)+cost_wqp_analyze_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ep))*	Cost applies as written to NTNCWSs.	At or below AL	Model PWSs serving ≤50,000 without CCT and have a copper ALE *p_copper_ale*	Every two weeks per event
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ph_ep_op*rate_op)+cost_wqp_analyze_ph_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ph_ep))*			Model PWSs serving ≤10,000 that have pH adjustment and a copper ALE *p_copper_ale, pbaseph*	
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((numb_ep*numb_ep_wqp)*pp_lab_samp)*((hrs_wqp_analyze_ortho_ep_op*rate_op)+cost_wqp_analyze_ortho_ep))+(((numb_ep*numb_ep_wqp)*pp_commercial_samp)*cost_lab_wqp_ortho_ep))*			Model PWSs serving ≤10,000 that have PO_4 or both PO_4 and pH adjustment and have a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

<table>
<tr><th rowspan="2">CWS Cost Per Activity</th><th rowspan="2">NTNCWS Cost Per Activity</th><th colspan="2">Conditions for Cost to Apply to a Model PWS</th><th rowspan="2">Frequency of Activity</th></tr>
<tr><th>Lead 90th - Range</th><th>Other Conditions</th></tr>
<tr><td colspan="5">ee) Report copper WQP sampling data and compliance with OWQPs to the State</td></tr>
<tr><td rowspan="3">The labor hours for reporting per system multiplied by the labor rate.

(hrs_report_wqp_op*rate_op)</td><td rowspan="3">Cost applies as written to NTNCWSs.</td><td rowspan="3">At or below AL</td><td>Model PWSs serving ≤50,000 without CCT and have a copper ALE

p_copper_ale</td><td rowspan="3">Twice per event</td></tr>
<tr><td>Model PWSs serving ≤10,000 that have pH adjustment and a copper ALE

p_copper_ale, pbaseph</td></tr>
<tr><td>Model PWSs serving ≤10,000 that have PO_4 or both PO_4 and pH adjustment and have a copper ALE

p_copper_ale, pbasepo4, pbasephpo4</td></tr>
</table>

Acronyms: AL = action level; ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PO_4 = orthophosphate; OWQP = optimal water quality parameter; PWS = public water system; WQP = water quality parameter.

Note:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_enhance_wqp*: number of distribution system samples for systems on standard WQP monitoring (Section 4.3.2.2.3).
- *numb_ep*: number of entry points per systems (Section 4.3.2.2.3).
- *numb_ep_wqp*: number of entry points samples per systems (Section 4.3.2.2.3).
- *numb_reduced_wqp*: number of distribution system samples for systems on reduced WQP monitoring (Section 4.3.2.2.3).
- *pbaseph*: likelihood a system has an existing CCT of modify pH (Section 4.3.2.2.1).
- *pbasepo4*: likelihood a system has existing CCT of adding PO_4 without pH post treatment (Section 4.3.2.2.1).
- *rate_op*: PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

4.3.2.4 PWS Source Water Monitoring

This discussion of source water monitoring costs for water systems is presented in the following subsections:

- 4.3.2.4.1: Applicability and Required Number of Samples
- 4.3.2.4.2: Source Water Monitoring Activities

4.3.2.4.1 Applicability and Required Number of Samples

Under the final LCRI, CWSs and NTNCWSs must sample at each entry point if the system experiences a significant source water change and/or has not already conducted source water monitoring for a previous lead or copper ALE. The likelihood of a significant source change or ALE, as well as the required number of source water samples, are described below.

Applicability

Section 3.3.9.1 in Chapter 3 provides the EPA's approach for using historical SDWIS/Fed data to estimate the likelihood that systems would have a source change in any given year (*p_source_chng*) of 0.0388 for all CWSs and 0.0278 percent for all NTNCWSs. The EPA developed a second related data input, *p_source_sig*, using the same data set to estimate the likelihood that a source change would be a significant change, *i.e.*, one in which a system changed its primary source. The EPA set *p_source_sig* to 0.001 for CWSs and NTNCWSs. The likelihoods *p_source_chng* and *p_source_sig* are multiplied to determine the joint likelihood that a system that makes a source change will be required to take additional actions such as source water monitoring.

Lead and/or Copper ALE

Under the LCRI, the SafeWater LCR model assigns the source water monitoring burden and costs described in Section 4.3.2.4.2 to any system the first time they exceed the lead and/or copper AL. A discussion of the EPA's approach for estimating the likelihood a system will initially have a lead ALE under the final LCRI is provided in Section 3.3.5.1 of Chapter 3, with the estimated percentages provided in Exhibit 3-26. The likelihood a system will have a copper ALE is provided in Section 4.3.2.3.1. Note that this approach may result in an overestimation of cost because the final LCRI allows systems to forego source water monitoring if they previously sampled source water in response to an ALE, the State has not required source water treatment, and they have not added any new water sources that change their primacy source type. For modeling purposes no system is assumed to have source water treatment.

Number of Samples

The rule does not specify that systems must collect multiple samples per entry point. Thus, for the cost model the agency assumed each system would collect one sample per entry point (*numb_st_sample*). See Section 3.3.6.1 of Chapter 3 for a discussion of how the EPA estimated the number of entry points per CWS and NTNCWS.

4.3.2.4.2 Source Water Monitoring Activities

The EPA has developed system costs for three source water monitoring activities as shown in Exhibit 4-42. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the

estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the State instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 4-42: PWS Source Monitoring Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
ff) Collect source water sample	Burden 0.5 hrs/sample Cost $1.12/sample for CWSs serving > 100K	Burden *hrs_source_op* Cost *cost_source_material*[1]
gg) Analyze source water sample	In-House Burden 0.44 hrs/sample for CWSs serving > 100K In-House Cost $3.92/sample for CWSs serving > 100K Commercial Cost $31.00/sample for CWSs serving ≤ 100K and NTNCWSs	In-House Burden *hrs_analyze_samp_op*[1] In-House Cost *cost_source_analyze*[1] Commercial Cost *cost_source*[1]
hh) Report source water monitoring results to the State	1 hour/report	*hrs_report_source_op*[1]

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Sources:

ff), hh): 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 15 (USEPA, 2022a); "Lead Analytical Burden and Costs_Final.xlsx," worksheets "Source_Collect_Analyze_CWS" and "Source_Collect_Analyze_NTNCWS."

gg): See file "Lead Analytical Burden and Costs_Final.xlsx," worksheets "Source_Collect_Analyze_CWS" and "Source_Collect_Analyze_NTNCWS."

Note:

[1] The burden and costs for these activities are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

ff) Collect source water sample (hrs_source_op, cost_source_material). CWSs and NTNCWSs with a significant source change and/or in response to their first lead or copper ALE will incur a burden of 0.5 hours to collect one source water sample at each entry point (*hrs_source_op*). This estimate is based on the system burden for source water sample collection in the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 15 (USEPA, 2022a).

Based on input from laboratories, the EPA assumed only CWSs serving more than 100,000 people will conduct analyses in-house, *i.e.*, *pp_lab_samp* is 1 for CWSs serving more than 100,000 people and 0 for all other CWSs and NTNCWSs. Conversely, the assigned likelihood a system will use a

commercial laboratory, i.e., *pp_commercial_samp* is 0 for CWSs serving more than 100,000 people and 1 for all other systems.

Commercial laboratories provide bottles as part of their services. Thus, CWSs serving 100,000 or fewer people and NTNCWSs will not incur bottle costs. CWSs serving more than 100,000 people are assumed to purchase a 250-ml sample bottle in bulk at a per bottle cost of $1.12 based on quotes from six vendors *(cost_source_material)*.

gg) Analyze source water samples (hrs_analyze_samp_op, cost_source_analyze, cost_source). The EPA assumed only CWSs serving more than 100,000 people will conduct analyses in-house and require 0.44 hours based on quotes from three laboratories. They will also incur in-house consumable costs of $3.92 based on information from three vendors *(cost_source_analyze).* CWSs serving 100,000 or fewer people and NTNCWSs will incur a cost of $31.00 per sample to have a commercial laboratory conduct the lead analyses *(cost_source)*. This includes $23.50 for the lead analysis based on quotes from seven laboratories and a cost to ship a sample to the laboratory of $7.50.

hh) Report source water monitoring results to the State (hrs_report_source_op). Water systems are required to report their source water monitoring results to the State. The EPA assumed that both CWSs and NTNCWSs would report electronically and would not incur costs for paper, an envelope, or postage. The agency did not have specific data on the time it would take to develop and submit a report for the source water sampling results. Instead, in order to estimate this value, the EPA employed the general assumption that a water system would require twice the time to prepare the report as that needed for the State to review the report. The EPA used an estimate from Exhibit 48 of the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* indicating a State burden of 0.5 hours for review of a “Source Water Monitoring Letter” submitted from a water system (USEPA, 2022a). Therefore, the EPA assumed that systems would incur an average burden of 1 hour to produce and submit this report for each monitoring period in which they conduct source water monitoring *(hrs_report_source_op)*.

Exhibit 4-43 provides the SafeWater LCR model cost estimation approach for system source water monitoring activities including additional cost inputs required to calculate these costs.

Exhibit 4-43: PWS Source Water Monitoring Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS: Lead 90th - Range	Conditions for Cost to Apply to a Model PWS: Other Conditions[2]	Frequency of Activity
ff) Collect source water sample[3]				
The number of entry points per system multiplied by the number of samples, then multiplied by the total of the labor hours per sample times the system labor rate, plus the cost per sample. *((numb_ep*numb_st_sample)*((hrs_source_op*rate_op)+cost_source_material))*	Cost applies as written to NTNCWSs.	All	Model PWSs with a significant change in source water *p_source_chng * p_source_sig*	Once per event
		At or below AL	Model PWSs with a copper ALE but no lead ALE *p_copper_ale*	One time
		Above AL	All model PWSs	
gg) Analyze source water samples[3]				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((pp_lab_samp*(numb_ep*numb_st_sample))*((hrs_analyze_samp_op*rate_op)+cost_source_analyze))+((pp_commercial_samp*(numb_ep*numb_st_sample))*cost_source)*	Cost applies as written to NTNCWSs.	All	Model PWSs with a significant change in source water *p_source_chng * p_source_sig*	Once per event
		At or below AL	Model PWSs with a copper ALE but no lead ALE *p_copper_ale*	One time
		Above AL	All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90^{th} - Range	Other Conditions[2]	
hh) Report source water monitoring results to the State[3]				
The total reporting hours per system multiplied by the labor rate. *(hrs_report_source_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs with a significant change in source water *p_source_chng * p_source_sig*	Once per event
		At or below AL	Model PWSs with a copper ALE but no lead ALE *p_copper_ale*	One time
		Above AL	All model PWSs	

Acronyms: AL = action level; ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_ep:* number of entry points per systems (Section 4.3.2.2.3).
- *numb_st_samp:* number of samples per entry point for source water monitoring (Section 4.3.2.4.1).
- *p_copper_ale:* likelihood a system with exceed the copper AL but not the lead AL (Section 4.3.2.3.1).
- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).
- *p_source_chng:* Likelihood a system will have a source change (Chapter 3, Section 3.3.9.1).
- *p_source_sig:* Likelihood that the system will have a significant change in which it changes its primary source, *e.g.*, for ground water to surface water (Chapter 3, Section 3.3.9.2).

[2] The likelihoods of *p_source_chng* and *p_source_sig* are multiplied to determine the joint likelihood that a system that makes a source change will be required to conduct source water monitoring.

[3] The burden and cost to provide sample bottles (*cost_source_material*) under activity ff), conduct analyses under activity gg), and report source water sample results to the system under activity hh) are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina (ASDWA, 2020a).

4.3.2.5 CWS School and Child Care Facility Lead Sampling Costs

The final LCRI requires CWSs to implement a public education and lead in drinking water testing program at public and private K-12 schools and licensed child care facilities. CWSs must collect five samples per tested school *(numb_samp_five)* and two samples at each tested child care facility *(numb_samp_two)*. The rule splits this testing program into two phases. The first testing phase occurs at elementary schools and child care facilities during the first 5 years of rule implementation, which is assumed to occur in Years 4 through 8 of the 35-year period of analysis. During the first five-year cycle, systems must schedule and conduct testing at 20 percent of elementary schools and 20 percent of child care facilities *(pp_mand_twenty_partic)* per year such that each would be tested once in the five-year period. CWSs may count any refusals or non-responses as part of the 20 percent. The final LCRI requires water system to make at least two attempts to schedule sampling. The EPA assumed all elementary

schools and child facilities would accept sampling. CWSs are also required to annually provide secondary schools with information on how to request sampling and must sample if requested by the school. In Years 9 onward, CWSs are only required to test elementary schools, secondary schools, and child care facilities that request testing. The EPA assumed 5 percent of elementary schools and child care facilities would request testing each year, starting in Year 9 and 5 percent of secondary schools would request testing each year, starting in Year 4 (*pp_voluntary_partic*).

Exhibit 3-57 in Chapter 3 provides the estimated number of public elementary schools, public secondary schools, private elementary schools, private secondary schools, and child care facilities served by CWSs for States, territories, and the Navajo Nation. Exhibit 3-58 is a continuation of Exhibit 3-57 and includes the number of schools and child care facilities per CWS population served for each State. The SafeWater LCR model applies the number of schools per CWS population served per State, to estimate the number of:

- Public elementary schools per system that corresponds to SafeWater LCR model data variable, *numb_elem_schools pub* (see Column K of Exhibit 3-57 for public elementary schools per person served by a CWS);
- Private elementary schools per system that corresponds to SafeWater LCR model data variable, *numb_elem_schools priv* (see Column N of Exhibit 3-57 for private elementary schools per person served by a CWS);
- Public secondary schools per system that corresponds to SafeWater LCR model data variable, *numb_second_schools pub* (see Column J of Exhibit 3-57 for public secondary schools per person served by a CWS);
- Private secondary schools per system that corresponds to SafeWater LCR model data variable, *numb_elem_schools priv* (see Column M of Exhibit 3-57 for private secondary schools per person served by a CWS); and
- Child care facilities per system that corresponds to SafeWater LCR model data variable, *numb_daycares* (see Column O of Exhibit 3-57 for child care facilities per person served by a CWS).

As previously discussed in Section 3.3.10.2, States with existing lead in drinking water programs at schools and/or child care facilities that are at least as stringent as the final LCRI requirements can waive these requirements for CWSs. In addition, CWSs can receive waivers to sample in schools and child care facilities during the first 5-year testing cycle if the facility has been sampled between January 1, 2021, and the LCRI compliance date. Exhibit 3-71 provides the percentage of elementary schools and child care facilities for which CWSs will receive a waiver for the first five-year cycle or the entire testing program. For additional detail, refer to Chapter 3, Section 3.3.10.2 and the file, “School_Child Care Inputs_Final.xlsx" (available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov) for additional information.

The requirements and associated costing inputs are described in more detail for the first testing cycle in Section 4.3.2.5.1 and upon request program in Section 4.3.2.5.2.

4.3.2.5.1 First Five-Year Testing Cycle

The EPA has developed system burden and costs to implement a lead in drinking water testing program at elementary schools and child care facilities for the first five-year testing cycle as shown in Exhibit 4-44. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the State instead of the CWS. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 4-44: CWS School and Child Care Facility Sampling Unit Burden and Cost Estimates for the First Five-Year Testing Cycle (Years 4 - 8)

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
ii) Create a list of schools and child care facilities served by the CWS and submit to the State (one-time)	0.08 hrs/school or child care facility	*hrs_school_identify_op*
jj) Develop lead outreach materials for schools and child care facilities (one-time)	7 hrs/CWS	*hrs_devel_pe_school_op*
kk) Prepare and distribute initial letters explaining the sampling program and the EPA's 3Ts Toolkit (one-time)	Burden 0.05 to 0.11 hrs/school or child care facility Cost $0.47 to $0.72/ school or child care facility	Burden *hrs_school_letter_op* Cost *cost_school_letter*
ll) Contact elementary school or child care facility to determine and finalize its sampling schedule (one-time) or contact secondary school to offer sampling (annual)	School 0.5 hrs/elementary school (one-time) 0.05 to 0.11/secondary school (annual) School Cost $0.47 to $0.72/secondary school Child Care Facility 1 hr/child care facility	School *hrs_school_call_op (elementary)* *hrs_school_annual_contact_op (secondary)* Cost *cost_school_annual_contact (secondary)* Child Care Facility *hrs_childcare_call_op*
mm) Contact school or child care facility to coordinate sample collection logistics	0.25 hrs/school or child care facility	*hrs_school_coor_sample_op*
nn) Conduct walkthrough at school or child care facility before the start of sampling	Burden 1.40 to 1.71 hrs/school or child care facility Cost $5.75 to $10.24/school or child care facility	Burden *hrs_walkthrough_school_op* Cost *cost_walkthrough_school*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
oo) Travel to collect samples	Burden 0.40 to 0.71 hrs/school or child care facility Cost $5.75 to $10.24/school or child care facility	Burden *hrs_travel_samp_school_op* Cost *cost_travel_samp_school*
pp) Collect samples	Burden 0.17 hrs/sample Cost $1.12/sample for CWSs serving > 100,000 people	Burden *hrs_collect_samp_school_op* Cost *cost_collect_samp_school*[1]
qq) Analyze samples	In-House Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample Cost: $3.92/sample Commercial Analysis $31.00/sample	In-House Analysis *hrs_analyze_samp_op*[1] *cost_lab_lt_samp*[1] Commercial Analysis *cost_commercial_lab*[1]
rr) Provide sampling results to tested facilities	Burden 0.05 to 0.11 hrs/tested facility Cost $0.72/ tested facility	Burden *hrs_inform_samp_pe_school_op* Cost *cost_inform_samp_pe_school*
ss) Discuss sampling results with the school and child care facility	1 hr/school or child care facility	*hrs_result_discuss_op*
tt) Conduct detailed discussion of high sampling results with schools and child care facilities	5 hr/sample	Burden *hrs_school_help_op*
uu) Report school and child care facility sampling results to the State	Burden 12 hrs/CWS	Burden *hrs_report_sch_cc_results_op*
vv) Prepare and provide annual report on school and child care facility sampling program to the State	Burden 1 to 8 hrs/CWS Cost $0.72/CWS	Burden *hrs_annual_report_school_prepare_op* Cost *cost_annual_report_school_dist*

Acronyms: AL = action level; 3Ts Toolkit = "3Ts for Reducing Lead in Drinking Water Toolkit"; CWS = community water system; PWS = public water system.
Source: "School_Child Care Inputs_Final.xlsx." Other data sources are provided following this exhibit for each activity, as applicable.
Note:
[1] The burden and costs for these activities are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

ii) Create a list of schools and child care facilities served by CWS and submit to the State (hrs_school_identify_op). The EPA assumed all CWSs would incur a burden at the start of the program to create a contact list of schools and child care facilities in their service area and spend an

average of 5 minutes (0.08 hours) per school or child care facility. The EPA assumed a system can use its customer database and obtain needed additional information online. Although systems serving more than 10,000 people may spend less time to identify each facility, they are assumed to use additional hours to create an electronic tracking system. Thus, the EPA also applied the 0.08 hours per facility to these larger systems.

jj) ***Develop lead outreach for schools and child care facilities (hrs_devel_pe_school_op).*** The EPA assumed all CWSs would spend 7 hours to prepare outreach materials that describe the importance of lead testing and the systems lead in drinking water testing program and submit these materials for State review. The burden estimate of 7 hours is based on the hours to prepare additional brochure language from Exhibit 33a of the 2022 Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal) (USEPA, 2022a).

kk) ***Prepare and distribute the initial letters (hrs_school_letter_op, cost_school_letter).*** The EPA assumed all CWSs would incur a one-time burden at the start of the program to prepare and distribute an initial letter explaining the sampling program and providing a link to the EPA's "3Ts for Reducing Lead in Drinking Water Toolkit" (3Ts Toolkit) (USEPA, 2018). The EPA estimated on average systems serving 3,300 or fewer people would spend 1 hour per 9 letters (0.05 hours) and those serving more than 3,300 people would spend 1 hour per 20 letters (0.11 hours) per school or child care facility *(hrs_school_letter_op)*. This estimate is based on the burden for a system to inform customers of their lead testing results as documented in the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 29 (Note G) (USEPA, 2022a). Note that the EPA conservatively assumed that systems will send letters to every school. However, the system may be able to send a letter to a single school district instead of individual schools as a cost savings.

CWSs will also incur paper ($0.019), ink ($0.06), envelope ($0.092), and first class ($0.55) or bulk rate postage costs ($0.299) to distribute the letter *(cost_school_letter)*. CWSs serving 100,000 or fewer people will incur total materials cost per letter of $0.72 and those serving more than 100,000 will incur a total cost of $0.47 due to the bulk postage rate discount.

ll) ***Contact elementary school or child care facility to determine and finalize its sampling schedule (hrs_school_call_op, hrs_childcare_call_op) and contact secondary schools to offer sampling (hrs_school_annual_contact_op, cost_school_annual_contact).*** The EPA assumed CWSs would coordinate with each elementary school or child care facility at the start of the program to plan when each facility will be sampled. The EPA estimated CWSs would require two phone calls to reach the appropriate person at an average of 15 minutes (0.25 hours) per call for a total of 0.5 hours per school for this one-time activity. The EPA assumed CWSs would require additional time to contact each child care facility at the start of the program to plan when each will be sampled. Some licensed day cares are home-based facilities that may not have additional support staff and may require multiple calls to reach the needed individual. The EPA estimated CWSs would require four calls at an average of 15 minutes per call for a total of 1 hour for this one-time activity.

CWSs will send a letter to each secondary schools annually starting in Year 4 of the analysis period explaining the sampling program, asking if the school wants to have their taps tested, and providing health information on lead and a link to the EPA's 3Ts (USEPA, 2018). The EPA estimated on average systems serving 3,300 or fewer people would spend 1 hour per 9 letters (0.05 hours) and those

serving more than 3,300 people would spend 1 hour per 20 letters (0.11 hours) per school *(hrs_school_letter_op)*. This estimate is based on the burden for a system to inform customers of their lead testing results as documented in the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 29 (Note G) (USEPA, 2022a). Note that the EPA conservatively assumed that systems will send letters to every school. However, the system may be able to send a letter to a single school district instead of individual schools as a cost savings.

CWSs will also incur paper ($0.019), ink ($0.06), envelope ($0.092), and first class ($0.55) or bulk rate postage costs ($0.299) to distribute the letter *(cost_school_letter)*. CWSs serving 100,000 or fewer people will incur total materials cost per letter of $0.72 and those serving more than 100,000 will incur a total cost of $0.47 due to the bulk postage rate $0.47 per letter.

mm) Contact school or child care facility to coordinate sample collection logistics (hrs_school_coor_sample_op). The EPA assumed CWSs will spend an average of 15 minutes (0.25 hours) calling each school or child care facility to coordinate sample collection logistics including scheduling a walkthrough.

nn) Conduct walkthrough at school or child care facility before the start of sampling (hrs_walkthrough_school_op, cost_walkthrough_school). The EPA assumed CWSs will conduct a walkthrough with each school or child care facility to become familiar with the facility and to identify sampling sites. The EPA assumed the following burden, which includes travel time roundtrip to each facility plus one hour spent conducting the walkthrough *(hrs_walkthrough_school_op)* given the equations below:

- CWSs serving 100,000 or fewer people: 1.40 hours = ((5.0 miles * 2)/25 miles per hr) + 1 hr
- CWSs serving 100,001 to 1,000,000 people: 1.51 hours = ((6.4 miles * 2)/25 miles per hr) + 1 hr
- CWSs serving more than 1,000,000 people: 1.71 hours = ((8.9 miles * 2)/25 miles per hr) + 1 hr.

These estimates are based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 5.0 miles for those serving ≤ 100,000 people, 6.4 miles for those serving 100,001 – 1,000,000 people, and 8.9 miles for those serving greater than 1,000,000 people. For additional detail on how these estimates were derived, see “Estimated Driving Distances_Final.xlsx” EPA assumed an average speed of 25 miles per hour.

Systems will also incur travel costs to conduct this walkthrough *(cost_walkthrough_school)* as follows:

- CWSs serving 100,000 or fewer people: $5.75 = (5.0 miles * 2) * $0.575 per mile
- CWSs serving 100,001 to 1,000,000 people: $7.36 = (6.4 miles * 2) * $0.575 per mile
- CWSs serving more than 1,000,000 people: $10.24 = (8.9 miles * 2) * $0.575 per mile.

The EPA assumed a mileage cost of $0.575 per mile using the 2020 federal reimbursement rate from the United States General Services Administration (GSA) (available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov).

oo) Travel to collect samples (hrs_travel_samp_school_op, cost_travel_samp_school). The EPA assumed CWSs will incur burden to travel to a school or child care facility to collect samples *(hrs_travel_samp_school_op)*. The EPA assumed CWSs serving 100,000 or fewer people will spend 0.40 hours traveling round trip, those serving 100,001 to 1 million people will spend 0.51 hours, and those serving more than 1 million people will spend 0.71 hours. The EPA used the same assumptions as those used to develop *hrs_walkthrough_school_op* that is discussed in activity nn) above excluding the 1 hour to conduct a walkthrough.

CWSs will also incur vehicle costs for this roundtrip travel *(cost_travel_samp_school)*. The EPA used the same assumptions as those for *cost_walkthrough_school* that is discussed in activity nn). The EPA assumed the following costs: $5.75 for CWSs serving 100,000 or fewer people, $7.36 for those serving 100,001 to 1 million people, and $10.24 for those serving more than 1 million people.

pp) Collect samples (hrs_collect_samp_school_op, cost_collect_samp_school). The final LCRI requires CWSs to provide instructions to facilities on how to identify outlets for sampling at least 30 days prior to sampling. For cost modeling purposes, the EPA assumed CWSs would collect the samples and would require 10 minutes (0.17 hours) per sample *(hrs_collect_samp_school_op*). This estimate is based on the assumption that the sample locations will be in the same building and the CWS has previously conducted a walkthrough to identify sampling locations.

Based on information from laboratories, only CWSs serving more than 100,000 people are assumed to conduct in-house analyses for lead; whereas those serving 100,000 or fewer people will use a commercial lab. Bottles are supplied by the commercial lab. Thus, CWSs serving more than 100,000 people will incur a $1.12 per 250-mL wide mouth bottle based on the bulk discount costs from six sources (refer to “Lead_WQP_Sample Bottle Costs_Final.xlsx" for additional detail).

qq) Analyze samples (hrs_analyze_samp_op, cost_lab_lt_samp, cost_commercial_lab). CWSs will incur the same burden and cost to analyze the school and child care facility lead samples as they do analyzing compliance lead tap samples. Therefore, the EPA used the same cost data variables for both in-house and commercial laboratory analysis of lead tap samples. Specifically, CWSs serving more than 100,000 people will incur a burden of 0.44 hours per sample (*hrs_analyze_samp_op*) and a cost of $3.92 per sample (*cost_lab_lt_samp*) to analyze lead samples in-house. For these systems the likelihood that a sample will be analyzed in-house is 1 (*pp_lab_samp_school*) and the likelihood that the sample will be analyzed commercially is 0 (*pp_commercial_samp_school*). CWSs serving 100,000 or fewer will use a commercial lab at a cost of $23.50 per sample and a cost of $7.50 to ship the sample to the lab for a total cost of $31.00 per sample (*cost_commercial_lab*). For these systems *pp_lab_samp_school* is 0 and *pp_commercial_samp_school* is 1. See Section 4.3.2.1.2, activity k) for additional detail.

rr) Provide sampling results to tested facilities (hrs_inform_samp_pe_school_op, cost_inform_samp_pe_school). CWSs must provide sampling results to each tested facility. The EPA assumed systems will spend 0.05 hours or 1 hour per 20 letters for systems serving 3,300 or fewer people and 0.11 hours or 1 hour per 9 letter for systems serving more than 3,300 people

(*hrs_inform_samp_pe_school_op*). This estimate is based on the burden for a system to inform customers of their lead testing results as documented in the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 29 (Note G) (USEPA, 2022a). The EPA also assumed CWSs will incur a material cost of $0.72/letter *(cost_inform_samp_pe_school)*. The EPA assumed information will be provided via mail (1 page of information, double-sided). Material costs include paper ($0.019), ink ($0.06), envelope ($0.092), and first class postage ($0.55). CWSs will provide the results of all testing to the State within 30 days of receiving the results, which is discussed under activity uu) below. Systems must also provide these results to local and State health departments within 30 days of receiving the results. The burden and cost for this activity is captured in the data variables, *hrs_hc_op* and *cost_hc* (see Section 4.3.6.2, activity l)).

ss) Discuss sampling results with the school and child care facilities (hrs_result_discuss_op). Although not explicitly required under the final LCRI, the EPA assumed CWSs will incur additional burden to discuss the sampling results with each school and child care facility at an average burden of 1 hour per tested facility.

tt) Conduct detailed discussion of high sampling results with schools and child care facilities (hrs_school_help_op). Although not explicitly required under the final LCRI, for each sample result over the AL, the EPA assumed CWSs will spend approximately 5 hours discussing in greater detail the sampling result(s) and the 3Ts Toolkit (USEPA, 2018). The estimate includes time for the system to explain the relevant portions of the 3Ts Toolkit and to address any follow-up questions that the school or child care facility might have after the initial discussion.

uu) Report school and child care facility sampling results to the State (hrs_report_sch_cc_results_op). Under the final LCRI, CWSs will be required to provide school and child care facility testing results to their State within 30 days of receiving the analytical results. The EPA assumed that CWSs will sample a portion of schools and child care facilities each month and would require 1 hour each month. For smaller CWSs with few schools and child care facilities, this may be an overestimation of the burden. In addition, the EPA assumed systems would email the sampling results and incur no non-labor costs.

vv) Prepare and provide an annual report on testing program to the State (hrs_annual_report_school_prepare_op, cost_annual_report_school_dist). CWSs are required to prepare and provide an annual report to the State regarding their testing program at schools and child care facilities. The report certifies that the CWS made a good faith effort to identify all schools and child care facilities they serve, summarizes all sampling activities conducted at schools and child care facilities in a system's service area, and documents attempts that resulted in no response. Every five years, the system must include any updates to the list of schools or child cares facilities or confirmation of no change and is provided to the State. CWSs must keep documentation regarding schools and child care facilities that are non-responsive or decline to participate in the testing program. For modeling purposes, the EPA assumed all schools and child care facilities would elect to participate in the testing program because the testing if free and they would want to better understand their potential sources of lead in drinking water.

The EPA assumed systems would incur the following burden to prepare and distribute the annual report *(hrs_annual_report_school_prepare_op)*:

- CWSs serving 100,000 or fewer people will incur a burden of 1 hour to prepare this report. This effort is similar to the estimated burden for a system of this size to report lead tap results and the 90th percentile calculation.

- CWSs serving more than 100,000 people will be conducting sampling at a much larger number of schools and child care facilities per year than smaller systems. CWSs serving more than 100,000 people are assumed to have sophisticated tracking systems that can be used to generate their reports. The EPA assumed systems serving 100,001 to 1,000,000 will require 2 hours and those serving more than 1,000,000 will require 8 hours to prepare the annual report.

Systems also will incur mailing costs for paper ($0.019), ink ($0.06), envelope ($0.092), and first-class postage ($0.55) to send a report to the State *(cost_annual_report_school_dist)*. The material cost for this report is $0.72***.***

Exhibit 4-45 provides the SafeWater LCR model cost estimation approach for each activity under the first testing cycle including additional cost inputs required to calculate these costs.

Exhibit 4-45: CWS School and Child Care Facility First Five-Year Testing Cycle Cost Estimation in SafeWater LCR by Activity[1, 2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ii) Create a list of schools and child care facilities and submit to the State				
The number of public elementary schools per system population times the system population multiplied by the hours to identify each facility and the system labor rate. *numb_elem_schools_pub*pws_pop*(hrs_school_identify_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	One time
The number of public secondary schools per system population times the system population multiplied by the hours to identify each school and the system labor rate. *numb_second_schools_pub*pws_pop*(hrs_school_identify_op*rate_op)*			All model PWSs	
The number of child care facilities per system population times the system population multiplied by the hours to identify each facility and the system labor rate. *numb_daycares**pws_pop**(hrs_school_identify_op*rate_op)*			All model PWSs	
The number of private elementary schools per system population times the system population multiplied by the hours to identify each facility and the system labor rate. *numb_elem_schools_priv*pws_pop*(hrs_school_identify_op*rate_op)*			All model PWSs	
The number of private secondary schools per system population times the system population multiplied by the hours to identify each school and the system labor rate. *numb_second_schools_priv*pws_pop*(hrs_school_identify_op*rate_op)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
jj) Develop lead outreach materials for schools and child care facilities				
The hours per system to develop the lead outreach materials times the system labor rate, plus the cost of materials. *(hrs_devel_pe_school_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	One time
kk) Prepare and distribute initial letters explaining the sampling program and the 3Ts Toolkit				
The number of public elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_pub*pws_pop*((hrs_school_letter_op*rate_op)+cost_school_letter)*	Cost does not apply to NTNCWSs.	All	All model PWSs	One time
The number of public secondary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_pub*pws_pop*((hrs_school_letter_op*rate_op)+cost_school_letter)*			All model PWSs	
The number of child care facilities requirements per system population times the system population multiplied by the hours per facility times the system labor rate, plus the cost of materials. *numb_daycares*pws_pop*((hrs_school_letter_op*rate_op)+cost_school_letter)*			All model PWSs	
The number of private elementary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_elem_schools_priv*pws_pop*((hrs_school_letter_op*rate_op)+cost_school_letter)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The number of private secondary schools per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *numb_second_schools_priv*pws_pop*((hrs_school_letter_op*rate_op) +cost_school_letter)*			All model PWSs	
II) Contact elementary school or child care facility to determine and finalize its sampling schedule and contact secondary school to offer sampling				
The number of public elementary schools that do not meet waiver requirements per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*(hrs_school_call_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	One time
The number of public secondary schools that do not meet waiver requirements per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			All model PWSs	
The number of child care facilities that do not meet waiver requirements per system population times the system population multiplied by the hours per facility and the system labor rate. *pp_childcare_mand_waiver *numb_daycares*(hrs_childcare_call_op*rate_op)*			All model PWSs	One time

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
The number of private elementary schools that do not meet waiver requirements per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*(hrs_school_call_op*rate_op)*			All model PWSs	
The number of private secondary schools that do not meet waiver requirements per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *pp_priv_second_onreq1_waiver *numb_second_schools_pub*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			All model PWSs	Once a year
mm) Contact school or child care facility to coordinate sample collection logistics				
20% of public elementary schools that do not meet waiver requirements multiplied by the hours per school and the system labor rate. *(pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*(hrs_school_coor_sample_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school and the system labor rate. *(pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop* pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			All model PWSs	
20% of child care facilities that do not meet waiver requirements multiplied by the hours per facility and the system labor rate. *(pp_childcare_mand_waiver *numb_daycares*pws_pop*pp_mand_twenty_partic)*(hrs_school_coor_sample_op*rate_op)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS: Lead 90th - Range	Conditions for Cost to Apply to a Model PWS: Other Conditions	Frequency of Activity
20% of private elementary schools that do not meet waiver requirements multiplied by the hours per school and the system labor rate. *(pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*(hrs_school_coor_sample_op*rate_op)*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school and the system labor rate. *(pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_pop* pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			All model PWSs	
nn) Conduct walkthrough at school or child care facility before start of sampling				
20% of public elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			All model PWSs	
20% of child care facilities that do not meet waiver requirements multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(pp_childcare_mand_waiver *numb_daycares*pws_pop*pp_mand_twenty_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
20% of private elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			All model PWSs	
oo) Travel to collect samples				
20% of public elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
20% of child care facilities that do not meet waiver requirements multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(pp_childcare_mand_waiver *numb_daycares*pp_mand_twenty_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			All model PWSs	
20% of private elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
pp) Collect samples[3]				
20% of public elementary schools that do not meet waiver requirements multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_popl*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			All model PWSs	
20% of child care facilities that do not meet waiver requirements multiplied by the number of samples per facility, is multiplied by the number of hours per facility times the system labor rate, plus the material cost. *(pp_childcare_mand_waiver *numb_daycares*pp_mand_twenty_partic)*numb_samp_two)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			All model PWSs	
20% of private elementary schools that do not meet waiver requirements multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
5% of private secondary schools that do not meet waiver requirements multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_popl*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	
qq) Analyze samples[3]				
The number of required samples per public elementary school multiplied by 20% of elementary schools that do not meet waiver requirements per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
The number of required samples per public secondary school multiplied by 5% of secondary schools that do not meet waiver requirements per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*			All model PWSs	

<table>
<tr><th rowspan="2">CWS Cost Per Activity</th><th rowspan="2">NTNCWS Cost Per Activity</th><th colspan="2">Conditions for Cost to Apply to a Model PWS</th><th rowspan="2">Frequency of Activity</th></tr>
<tr><th>Lead 90th - Range</th><th>Other Conditions</th></tr>
<tr><td>The number of required samples per child care facility multiplied by 20% of elementary schools that do not meet waiver requirements per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis.

((((pp_childcare_mand_waiver *numb_daycares*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((p_childcare_mand_waiver *numb_daycares*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)</td><td>Cost does not apply to NTNCWSs.</td><td>All</td><td>All model PWSs</td><td rowspan="3"></td></tr>
<tr><td>The number of required samples per private elementary school multiplied by 20% of elementary schools that do not meet waiver requirements per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis.

((((pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop *pp_mand_twenty_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)</td><td rowspan="2">Cost does not apply to NTNCWSs.</td><td rowspan="2">All</td><td>All model PWSs</td></tr>
<tr><td>The number of required samples per private secondary school multiplied by 5% of secondary schools that do not meet waiver requirements per year times by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis.

((((pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_pop *pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_pop *pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)</td><td>All model PWSs</td></tr>
</table>

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
rr) Provide sampling results to tested facilities				
20% of public elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	
20% of child care facilities that do not meet waiver requirements multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(pp_childcare_mand_waiver *numb_daycares*pws_pop*pp_mand_twenty_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*			All model PWSs	
20% of private elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ss) Discuss sampling results with the school and child care facilities				
20% of public elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate. *(pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)*(hrs_result_discuss_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate. *(pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop*pp_mand_voluntary_partic)*(hrs_result_discuss_op*rate_op)*			All model PWSs	
20% of child care facilities that do not meet waiver requirements multiplied by the hours per facility times the system labor rate. *(pp_childcare_mand_waiver *numb_daycares*pws_pop*pp_mand_twenty_partic)*(hrs_result_discuss_op*rate_op)*			All model PWSs	
20% of private elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate. *(pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)*(hrs_result_discuss_op*rate_op)*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate. *(pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
tt) Conduct detailed discussion of high sampling results with school and child care facilities				
20% of public elementary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate _op))*	Cost does not apply to NTNCWSs.	At or below the AL	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate _op))*			All model PWSs	
20% of child care facilities that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(pp_childcare_mand_waiver *numb_daycares*pws_pop*pp_mand_twenty_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate _op))*			All model PWSs	
20% of private elementary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate _op))*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
5% of private secondary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_pop* pp_voluntary_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	Once a year
20% of public elementary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(pp_pub_elem_mand_waiver *numb_elem_schools_pub*pws_pop*pp_mand_twenty_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*	Cost does not apply to NTNCWSs.	Above the AL	All model PWSs	
5% of public secondary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(pp_pub_second_onreq1_waiver *numb_second_schools_pub*pws_pop* pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	
20% of child care facilities that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(pp_childcare_mand_waiver *numb_daycares*pws_pop*pp_mand_twenty_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
20% of private elementary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(pp_priv_elem_mand_waiver *numb_elem_schools_priv*pws_pop*pp_mand_twenty_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(pp_priv_second_onreq1_waiver *numb_second_schools_priv*pws_pop* pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	
uu) Report school and child care facility sampling results to the State				
The total hours per system multiplied by the system labor rate. *(hrs_report_sch_cc_results_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
vv) Prepare and provide annual report on school and child care facility sampling to State				
The total hours per system multiplied by the system labor rate, plus the materials cost. *(hrs_annual_report_school_prepare_op*rate_op)+cost_annual_report_school_dist*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_daycares*, *numb_elem_schools_priv*, *numb_elem_school_pub*, *numb_second_schools_priv*, *numb_second_school_pub*: Number of child care facilities, number of private elementary schools, number of public elementary schools, number of public secondary schools, and number of private secondary schools, respectively that are served by CWSs (Section 3.3.10.1).

- *pp_childcare_mand_waiver, pp_priv_elem_mand_waiver*, *pp_pub_elem_mand_waiver, pp_pub_second_onreq1_waiver, pp_priv_second_onreq1_waiver*: States that qualify to waiver child care facilities, private K-12 schools, and public K-12 schools for the first testing phase (Section 3.3.10.2).
- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] The first testing cycle is assumed to occur in Years 4 through 8 at elementary schools and child care facilities.
[3] The burden and costs to provide sample bottles (*cost_collect_samp_school*) under activity pp) and conduct analyses under activity qq) are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina (ASDWA, 2020a).

4.3.2.5.2 Second Five-Year Testing Cycle On

Under the final LCRI, after CWSs complete one 5-year cycle of testing at elementary schools and child care facilities, testing at these facilities is on request only. In addition, CWSs are only required to test those secondary schools that request testing. The EPA assumed that 5 percent of elementary and secondary schools, and licensed child care facilities per year would elect to participate in the sampling program *(pp_voluntary_partic).* This estimate is based on the EPA's discussions with GCWW about their school testing program (available in the docket at EPA-HQ-OW-2022-0801). GCWW indicated that they had a low response rate from schools under their initial program that involved sending out letters to school districts offering to assist schools in testing their drinking water outlets for lead, which is similar to the on request program requirements.

The EPA has developed system burden and costs for 12 activities the agency has identified as necessary to implement the on request program for drinking water testing at schools and child care facilities as shown in Exhibit 4-46. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the State instead of the CWS. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 4-46: CWS School and Child Care Facility Sampling Unit Burden and Cost Estimates under the Second Five-Year Testing Cycle On

Activity	Unit Burden and/or Cost	***SafeWater LCR Data Variable***
ww) Update the list of schools and child care facilities and submit to the State (every five years)	0.08 hrs/school or child care facility	*hrs_school_identify_op*
xx) Contact school and child care facilities to offer sampling	Burden 0.05 to 0.11 hrs/school or child care facility Cost $0.47 to $0.72	Burden *hrs_school_annual_contact_op* Cost *cost_school_annual_contact*
yy) Contact the school or child care facility to coordinate sample collection logistics	0.25 hrs/school or child care facility	*hrs_school_coor_sample_op*
zz) Conduct walkthrough at school or child care facility before the start of sampling	Burden 1.40 to 1.71 hrs/school or child care facility Cost $5.75 to $10.24/school or child care facility	Burden *hrs_walkthrough_school_op* Cost *cost_walkthrough_school*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
aaa) Travel to collect samples	Burden 0.40 to 0.71 hrs/school or child care facility Cost $5.75 to $10.24/school or child care facility	Burden *hrs_travel_samp_school_op* Cost *cost_travel_samp_school*
bbb) Collect samples	Burden 0.17 hrs/sample Cost $1.12/sample for CWSs serving > 100K	Burden *hrs_collect_samp_school_op* Cost *cost_collect_samp_school*[1]
ccc) Analyze samples	In-house Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample Cost: $3.92/sample Commercial Analysis $31.00/sample	In-House Analysis *hrs_analyze_samp_op*[1] *cost_lab_lt_samp*[1] Commercial Analysis *cost_commercial_lab*[1]
ddd) Provide sampling results to tested facilities	Burden 0.05 to 0.11 hrs/tested facility Cost $0.72/ tested facility	Burden *hrs_inform_samp_pe_school_op* Cost *cost_inform_samp_pe_school*
eee) Discuss sampling results with the school and child care facility	1 hr/school or child care facility	*hrs_result_discuss_op*
fff) Conduct detailed discussion of high sampling results with schools and child care facilities	5 hr/sample	Burden *hrs_school_help_op*
ggg) Report school and child care facility sampling results to the State	Burden 12 hrs/CWS	Burden *hrs_report_sch_cc_results_op*
hhh) Prepare and provide annual report on school and child care facility sampling program to the State	Burden 1 to 8 hrs/CWS Cost $0.72/CWS	Burden *hrs_annual_report_school_prepare_op* Cost *cost_annual_report_school_dist*

Acronyms: AL = action level; CWS = community water system; PWS = public water system.
Source: "School_Child Care Inputs_Final.xlsx." Other data sources are provided following this exhibit for each activity, as applicable.
Note:
[1] The burden and costs for these activities are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina.

ww) Update the list of schools and child care facilities and submit to the State (hrs_school_identify_op). The EPA assumed all CWSs would incur a burden every five years to

update the contact list of schools and child care facilities in their service area and spend an average of 5 minutes (0.08 hours) per school or child care facility. The EPA assumed a system can use its customer database and obtain needed additional information online. Although systems serving more than 10,000 people may spend less time to identify each facility, they are assumed to use additional hours to create an electronic tracking system. Thus, the EPA also applied the 0.08 hours per facility to these larger systems.

xx) Contact schools and child care facilities to offer sampling (hrs_school_annual_contact_op, cost_school_annual_contact). CWSs will annually send a letter to each public and private elementary and secondary schools and child care facility explaining the sampling program, asking if the school/child care facility wants to have their taps tested, and providing health information on lead and a link to the 3Ts (USEPA, 2018). The EPA estimated on average systems serving 3,300 or fewer people would spend 1 hour per 9 letters (0.05 hours) and those serving more than 3,300 people would spend 1 hour per 20 letters (0.11 hours) per school or child care facility *(hrs_school_letter_op)*. This estimate is based on the burden for a system to inform customers of their lead testing results as documented in the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 29 (Note G) (USEPA, 2022a). Note that the EPA conservatively assumed that systems will send letters to every school. However, the system may be able to send a letter to a single school district instead of individual schools as a cost savings.

CWSs will also incur paper ($0.019), ink ($0.06), envelope ($0.092), and first class ($0.55) or bulk rate postage costs ($0.299) to distribute the letter *(cost_school_letter)*. CWSs serving 100,000 or fewer people will incur total materials cost per letter of $0.72 and those serving more than 100,000 will incur a total cost of $0.47 due to the bulk postage rate $0.47 per letter.

yy) Contact the school or child care facility to coordinate sample collection logistics (hrs_school_coor_sample_op). The EPA assumed CWSs would incur the same average burden as under the first testing cycle to call each facility to coordinate sample collection logistics including scheduling a walkthrough. The average time spent per call to coordinate sample collection logistics is 15 minutes (0.25 hours). See Section 4.3.2.5.1, activity mm) for additional detail.

zz) Conduct walkthrough at school or child care facility before the start of sampling (hrs_walkthrough_school_op, cost_walkthrough_school). The EPA assumed CWSs will incur the same burden and costs as under the first testing cycle to conduct a walkthrough with each school or child care facility to become familiar with the facility and to identify sampling sites. The burden and cost for the CWS to complete this task is 1.40 hours and $5.75 for CWSs serving 100,000 or fewer people, 1.64 hours and $7.36 for those serving 100,001 to 1 million people, and 1.71 hours and $10.24 for those serving more than 1 million people. See Section 4.3.2.5.1, activity nn) for additional detail.

aaa) Travel to collect samples (hrs_travel_samp_school_op, cost_travel_samp_school). The EPA assumed CWSs will incur the same burden and costs as under the first testing phase to travel to a school or child care facility to collect samples of 0.40 hours and $5.75 for CWSs serving 100,000 or fewer people, 0.51 hours and $7.36 for those serving 100,001 to 1 million people, and 0.71 hours and $10.24 for those serving more than 1 million people. See Section 4.3.2.5.1, activity oo) for additional detail.

bbb) Collect samples (hrs_collect_samp_school_op, cost_collect_samp_school). The EPA assumed CWSs will require the same per sample burden and cost to collect samples as under the first testing phase of 10 minutes (0.17 hours) for all system sizes and bottle cost of $1.12 that applies only to CWSs serving more than 100,000 people. See activity pp) for additional detail.

ccc) Analyze samples (hrs_analyze_samp_op, cost_lab_lt_samp, cost_commercial_lab). Under the on request program phase, CWSs will incur the same burden and cost to analyze lead samples in-house or to use a commercial laboratory as lead tap sampling and the first testing phase of the school and child care facility sampling program. Specifically, CWSs serving more than 100,000 people will incur a burden of 0.44 hours per sample (*hrs_analyze_samp_op*) and cost of $3.92 per sample (*cost_lab_lt_samp*) to analyze lead samples in-house. CWSs serving 100,000 or fewer people will use a commercial lab inclusive of shipping samples to the laboratory of $31.00 per sample (*cost_commercial_lab*). See Section 4.3.2.5.1, activity qq) for additional detail.

ddd) Provide sampling results to tested facilities (hrs_inform_samp_pe_school_op, cost_inform_samp_pe_school). CWSs will incur the same burden and costs as under the first testing phase to provide sampling results to tested facilities. The CWS burden is 0.05 to 0.11 hours and $0.72 per tested facility. See Section 4.3.2.5.1, activity rr) for additional detail.

eee) Discuss sampling results with the school and child care facility (hrs_result_discuss_op). CWSs will continue to incur burden to discuss the sampling results with each school and child care facility under the on request program phase. The EPA assumed the same average burden of 1 hour per tested facility as under the mandatory program.

fff) Conduct detailed discussion of high sampling results with the school and child care facility (hrs_school_help_op). For each lead sample result over the AL, the EPA assumed CWSs would incur the same burden of 5 hours to work with each school or child care facility as under the first phase of testing. See Section 4.3.2.5.1, activity tt) for additional detail).

ggg) Report school and child care facility sampling results to States. CWSs must also continue to report school and child care facility testing results to the States within 30 days of learning the results. The EPA estimated an annual burden of 12 hours (*i.e.*, 1 hour per monthly report). See Section 4.3.2.5.1, activity uu) for additional detail.

hhh) Prepare and provide an annual report on testing program to the State (hrs_annual_report_school_prepare_op, cost_annual_report_school_dist). CWSs must continue to prepare and distribute an annual report regarding their testing program at schools and child care facilities at an estimated burden of 1 hour for CWSs serving 100,000 or fewer people, 2 hours for those serving 100,001 to 1 million people, and 8 hours for CWSs serving more than 1 million people, and a cost of $0.72 for all system sizes. See Section 4.3.2.5.1, activity vv) for additional detail.

Exhibit 4-47 shows the SafeWater LCR model cost estimation approach for activities under the second five-year cycle including additional cost inputs required to calculate these costs.

Exhibit 4-47: CWS School and Child Care Facility Second Five-Year Testing Cycle Cost Estimation in SafeWater LCR by Activity[1,2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ww) Update the list of schools and child care facilities and submit to the State				
The number of public elementary schools per system population times the system population multiplied by the hours to identify each facility and the system labor rate. *numb_elem_schools_pub*pws_pop*(hrs_school_identify_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Every five years
The number of public secondary schools per system population times the system population multiplied by the hours to identify each school and the system labor rate. *numb_second_schools_pub*pws_pop*(hrs_school_identify_op*rate_op)*			All model PWSs	
The number of child care facilities per system population times the system population multiplied by the hours to identify each facility and the system labor rate. *numb_daycares*pws_pop*(hrs_school_identify_op*rate_op)*			All model PWSs	
The number of private elementary schools per system population times the system population multiplied by the hours to identify each facility and the system labor rate. *numb_elem_schools_priv*pws_pop*(hrs_school_identify_op*rate_op)*			All model PWSs	
The number of private secondary schools per system population times the system population multiplied by the hours to identify each school and the system labor rate. *numb_second_schools_priv*pws_pop*(hrs_school_identify_op*rate_op)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
xx) Contact schools and child care facilities to offer sampling				
The number of public elementary schools that do not meet waiver requirements per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
The number of public secondary schools that do not meet waiver requirements per system population times system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			All model PWSs	
The number of child care facilities that do not meet waiver requirements per system population times the system population multiplied by the hours per facility times the system labor rate, plus the cost of materials. *p_childcare_onreq_waiver_LCRI*numb_daycares*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			All model PWSs	
The number of private elementary schools that do not meet waiver requirements per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			All model PWSs	
The number of private secondary schools that do not meet waiver requirements per system population times the system population multiplied by the hours per school times the system labor rate, plus the cost of materials. *p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop* ((hrs_school_annual_contact_op *rate_op)+ cost_school_annual_contact)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
yy) Contact the school or child care facility to coordinate sample collection logistics				
5% of public elementary schools that do not meet waiver requirements multiplied by the hours per school and the system labor rate. *(p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school and the system labor rate. *(p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			All model PWSs	
5% of child care facilities that do not meet waiver requirements multiplied by the hours per facility and the system labor rate. *(p_childcare_onreq_waiver_LCRI*numb_daycares*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			All model PWSs	
5% of private elementary schools that do not meet waiver requirements multiplied by the hours per school and the system labor rate. *(p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school and the system labor rate. *(p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop*pp_voluntary_partic)*(hrs_school_coor_sample_op*rate_op)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
zz) Conduct walkthrough at school or child care facility before start of sampling				
5% of public elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			All model PWSs	
5% of child care facilities that do not meet waiver requirements multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(p_childcare_onreq_waiver_LCRI*numb_daycares*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			All model PWSs	
5% of private elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_walkthrough_school_op*rate_op)+cost_walkthrough_school)*			All model PWSs	
aaa) Travel to collect samples				
5% of public elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			All model PWSs	
5% of child care facilities that do not meet waiver requirements multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(p_childcare_onreq_waiver_LCRI*numb_daycares*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS: Lead 90th - Range	Conditions for Cost to Apply to a Model PWS: Other Conditions	Frequency of Activity
5% of private elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_travel_samp_school_op*rate_op)+cost_travel_samp_school)*			All model PWSs	
bbb) Collect samples[3]				
5% of public elementary schools that do not meet waiver requirements multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_popl*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			All model PWSs	
5% of child care facilities that do not meet waiver requirements multiplied by the number of samples per facility, is multiplied by the number of hours per facility times the system labor rate, plus the material cost. *(p_childcare_onreq_waiver_LCRI*numb_daycares*pp_voluntary_partic)*numb_samp_two)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS: Lead 90th - Range	Conditions for Cost to Apply to a Model PWS: Other Conditions	Frequency of Activity
5% of private elementary schools that do not meet waiver requirements multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the number of samples per school, is multiplied by the number of hours per school times the system labor rate, plus the material cost. *(p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_popl*pp_voluntary_partic)*numb_samp_five)*((hrs_collect_samp_school_op*rate_op)+cost_collect_samp_school)*			All model PWSs	
ccc) Analyze samples[3]				
The number of required samples per public elementary school that do not meet waiver requirements multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
The number of required samples per public secondary school that do not meet waiver requirements multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((p_pub_second_onreq2on_waiver_LCRI*numb_sec*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
*ond_schools_pub*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*				
The number of required samples per child care facility that do not meet waiver requirements multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((p_childcare_onreq_waiver_LCRI*numb_daycares*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((p_childcare_onreq_waiver_LCRI*numb_daycares*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*			All model PWSs	
The number of required samples per private elementary school that do not meet waiver requirements multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop *pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*	Cost does not apply to NTNCWSs.	All	All model PWSs	
The number of required samples per private secondary school that do not meet waiver requirements multiplied by 5 percent of elementary schools per year times the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *((((p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop *pp_voluntary_partic)*numb_samp_five)*pp_lab_samp_school)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+((((p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop *pp_voluntary_partic)*numb_samp_five)*pp_commercial_samp_school)*cost_commercial_lab)*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ddd) Provide sampling results to tested facilities				
5% of public elementary schools multiplied that do not meet waiver requirements by the hours per school times the system labor rate, plus the cost of materials. *(p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of child care facilities that do not meet waiver requirements multiplied by the hours per facility times the system labor rate, plus the cost of materials. *(p_childcare_onreq_waiver_LCRI*numb_daycares*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of private elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS: Lead 90th - Range	Conditions for Cost to Apply to a Model PWS: Other Conditions	Frequency of Activity
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate, plus the cost of materials. *(p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop*pp_voluntary_partic)*((hrs_inform_samp_pe_school_op*rate_op)+cost_inform_samp_pe_school)*			All model PWSs	
eee) Discuss sampling results with the school and child care facility				
5% of public elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate. *(p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate. *(p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of child care facilities that do not meet waiver requirements multiplied by the hours per facility times the system labor rate. *(p_childcare_onreq_waiver_LCRI*numb_daycares*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
5% of private elementary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate. *(p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS: Lead 90th - Range	Conditions for Cost to Apply to a Model PWS: Other Conditions	Frequency of Activity
5% of private secondary schools that do not meet waiver requirements multiplied by the hours per school times the system labor rate. *(p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop*pp_voluntary_partic)*(hrs_result_discuss_op*rate_op)*			All model PWSs	
fff) Conduct detailed discussion of high sampling results with schools and child care facilities				
5% of public elementary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*	Cost does not apply to NTNCWSs.	At or below the AL	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	
5% of child care facilities that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(p_childcare_onreq_waiver_LCRI*numb_daycares*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	
5% of private elementary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate.			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
*(p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_three*numb_samp_five)*(hrs_school_help_op*rate_op))*				
5% of public elementary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(p_pub_elem_onreq_waiver_LCRI*numb_elem_schools_pub*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*	Cost does not apply to NTNCWSs.	Above the AL	All model PWSs	Once a year
5% of public secondary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(p_pub_second_onreq2on_waiver_LCRI*numb_second_schools_pub*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	
5% of child care facilities that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(p_childcare_onreq_waiver_LCRI*numb_daycares*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	
5% of private elementary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(p_priv_elem_onreq_waiver_LCRI*numb_elem_schools_priv*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	
5% of private secondary schools that do not meet waiver requirements multiplied by the number of required samples per system above the AL multiplied by the hours per sample times the system labor rate. *(p_priv_second_onreq2on_waiver_LCRI*numb_second_schools_priv*pws_pop*pp_voluntary_partic)* ((pp_above_al_bin_one*numb_samp_five)*(hrs_school_help_op*rate_op))*			All model PWSs	

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
ggg) Report school and child care facility sampling results to the State				
The total hours per system multiplied by the system labor rate. *(hrs_report_sch_cc_results_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
hhh) Prepare and provide annual report on school and child care facility sampling to the State				
The total hours per system multiplied by the system labor rate, plus the materials cost. *(hrs_annual_report_school_prepare_op*rate_op)+cost_annual_report_school_dist)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_daycares*, *numb_elem_schools_priv*, *numb_elem_school_pub*, *numb_second_schools_priv*, *numb_second_school_pub*: Number of child care facilities, number of private elementary schools, number of public elementary schools, number of public secondary schools, and number of private secondary schools, respectively that are served by CWSs (Chapter 3, Section 3.3.10.1).
- *p_childcare_onreq_waiver_LCRI, p_priv_elem_onreq_waiver_LCRI*, *p_pub_elem_onreq_waiver_LCRI, p_pub_second_onreq2on_waiver_LCRI, p_priv_second_onreq2on_waiver_LCRI:* States and schools/child care facilities, private K-12 schools, and public K-12 schools for the second period on request program (Section 3.3.10.2).
- *rate_op*: PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] The second five-year testing cycle is assumed to start in Year 9.

[3] The burden and costs to provide sample bottles (*cost_collect_samp_school*) under activity bbb) and conduct analyses under activity ccc) are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina (ASDWA, 2020a).

4.3.2.6 Estimate of PWS National Sampling Costs

Exhibit 4-48 shows the total estimated national sampling costs, under the low and high scenarios, discounted at 2 percent for the 2021 LCRR and the final LCRI. The annual monetized incremental sampling costs range from $32.0 million and $32.6 million in 2022 dollars. Note, the more aggressive SL replacement requirements under the final LCRI, combined with the higher likelihood of PWSs having an ALE under the high scenario under both the 2021 LCRR and final LCRI, results in the high scenario lead tap sampling incremental cost being lower than the low scenario. See Section 4.2.2 for more detail on the factors that produce the difference between the low and high modeling scenarios.

Exhibit 4-48: Estimated National Annualized Sampling Costs - 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Lead Tap Sampling	$102.2	$98.7	-$3.5	$108.1	$103.5	-$4.6
Lead Water Quality Parameters Monitoring	$16.6	$35.6	$19.0	$20.1	$40.6	$20.5
Copper Water Quality Parameters Monitoring	$0.2	$0.2	$0.0	$0.2	$0.3	$0.1
Source Water Monitoring	$0.0	$0.0	$0.0	$0.0	$0.1	$0.1
School Sampling	$15.0	$31.5	$16.5	$15.2	$31.7	$16.5
Total Annual Sampling Costs	**$134.0**	**$166.0**	**$32.0**	**$143.6**	**$176.2**	**$32.6**

4.3.3 PWS Corrosion Control Costs

PWSs may be required to install CCT, re-optimize their existing CCT, or perform a distribution system and site assessment (DSSA)[108] adjustment to their CCT under the final LCRI. CCT installation and re-optimization are required based on the system's lead 90th percentile range. The likelihood of a model-PWS exceeding the lead AL of 10 µg/L for the low and high cost scenarios is in Exhibit 4-4. The DSSA adjustment to CCT is prompted by a requirement under the final LCRI where systems are required to take certain actions when individual lead tap samples are greater than 10 µg/L.

Any changes to the status of a system's CCT may result in technology related costs (capital and/or O&M), as well as ancillary costs for data submission, consultation, and CCT studies. This section presents the following CCT-related costs:

- 4.3.3.1: CCT Installation
- 4.3.3.2: Re-optimization

[108] This was previously known as "find-and-fix" under the 2021 LCRR.

- 4.3.3.3: DSSA Costs
- 4.3.3.4: System Lead CCT Routine Costs

Each subsection presents capital and O&M costs followed by ancillary costs. Note that PWS costs for monitoring of CCT effectiveness (*i.e.*, lead tap and WQP monitoring) has already been presented in Sections 4.3.2.1 and 4.3.2.2, respectively. Also note that WWTP costs to address increased phosphorus loadings are presented in Section 4.5.

All CCT-related capital and O&M costs are calculated using the EPA's WBS cost models, which are described in Section 4.2.2.3 and detailed in *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b). WBS capital cost equations are a function of design flow (DF), and WBS O&M cost equations are a function of average daily flow (ADF). These flows are estimated based on the system's retail population served. As explained in Chapter 3, Section 3.3.6 DF and ADF for the system are divided by the average number of entry points per system to calculate flow per entry point.[109] These entry point flow values are used in the WBS cost equations. CCT-related capital and O&M costs per entry point are summed for all entry points to produce the CCT-related capital and O&M costs for the system. As noted in Section 4.2.2.3, the EPA recognizes uncertainty in CCT capital and O&M cost equations by varying the WBS model inputs (e.g., fiberglass storage tank vs. more expensive stainless steel construction) to create "low" and "high" cost equations. Low CCT cost equations are used for the low cost scenario, and high CCT cost equations are used for the high cost scenario. These equations can be found in the *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b).

In order to estimate CCT installation, re-optimization, or DSSA costs, the SafeWater LCR model requires an estimate of the pH of the model-PWS's pre-regulatory compliance (or baseline) finished water. Using data from the Six-Year 3 Review Information Collection Request (ICR) Dataset, the EPA developed triangular distributions based on the minimum, mode, and maximum of baseline pH levels (converted to $\log_{10}$ values) for model-PWSs with and without existing pH adjustment. PFAS treatment is not expected to adversely impact pH as most systems were projected to use granular activated carbon, which does not impact pH. There is a pH impact from ion exchange, but only for a brief period after start-up. For each distribution, the EPA estimated distribution quartile threshold pH values and quartile midpoint values. Then the EPA estimated system-weighted averages of the midpoint values to derive the final set of distributions for ground water and surface water systems with and without baseline pH adjustment shown in Exhibit 4-49.

[109] In the case of some very large systems (VLSs), the EPA knows the flows at each of its entry points (EPs) and each EP's pH level. The SafeWater LCR model uses these data to calculate the CCT installation and O&M costs for each EP for these VLSs.

Exhibit 4-49: Distribution of Baseline Finished Water pH by Source Water Type and pH Adjustment Status

Likelihood	Finished Water pH			
	PWSs without pH Adjustment in Place		PWSs with pH Adjustment in Place	
	Groundwater	Surface Water	Groundwater	Surface Water
10%	5.1	5.6	6.3	6.3
15%	5.9	6.3	6.8	6.8
25%	6.6	6.8	7.3	7.2
25%	7.3	7.4	7.8	7.7
15%	8.0	7.9	8.3	8.3
10%	8.6	8.4	8.8	8.9

Acronyms: PWS = public water system.

The EPA then used the estimates in Exhibit 4-49 to develop the pH distribution for model-PWSs with 1) no CCT installed and 2) orthophosphate (PO_4) treatment installed. The EPA assumes that model-PWSs with no CCT would have pH of at least 7.0. Therefore, the EPA truncated the values for "PWSs without pH Adjustment in Place" which resulted in the distribution for the variable *baselineph_wocct*. Likewise, the EPA used the estimates in Exhibit 4-49 to develop the pH distribution for model-PWSs with PO_4 in place without pH adjustment. The EPA assumes that model-PWSs with only PO_4 installed would have pH of at least 6.3. Therefore, the EPA truncated the values for "PWSs without pH Adjustment in Place" which resulted in the distribution for the variable *baseline_woph*. The distributions for both *baselineph_wocct* and *baselineph_woph* are provided in Exhibit 4-50.

Exhibit 4-50: Distribution of Finished Water pH by Source Water Type for Model-PWSs without pH Adjustment in Place by CCT Status

Probability	Finished Water pH		Probability	Finished Water pH	
	PWSs without CCT in Place *baselineph_wocct*			PWSs with just PO_4 in Place *baselineph_woph*	
	Groundwater	Surface Water		Groundwater	Surface Water
			25%	6.3	6.3
50%	7.0	7.0	25%	6.6	6.8
25%	7.3	7.4	25%	7.3	7.4
15%	8.0	7.9	15%	8.0	7.9
10%	8.6	8.4	10%	8.6	8.4

Acronyms: CCT = corrosion control treatment; PO_4 = orthophosphate; PWS = public water system.

The EPA then used the estimates in Exhibit 4-49 to develop the pH distribution for model-PWSs with pH adjustment in place by CCT status. The EPA assumed that model-PWSs with PO_4 and pH adjustment could have any of the baseline pH levels associated with "PWSs with pH adjustment in place." Therefore, no adjustment to the pH distribution for "PWSs with pH Adjustment in Place" was required to develop the distribution for the variable *baselineph_wpo4ph*. However, the EPA determined that PWSs with only pH adjustment installed would have a pH of at least 8.2. Therefore, the EPA truncated the values for

"PWSs with pH Adjustment in Place" which resulted in the distribution for the variable *baseline_wph*. The distributions for both *baselineph_wpo4ph* and *baselineph_wph* are provided in Exhibit 4-51.

Exhibit 4-51: Distribution of Finished Water pH by Source Water Type for Model-PWSs with pH Adjustment in Place by CCT Status

Probability	Finished Water pH PWSs with PO_4 and pH Adjustment in Place *baselineph_wpo4ph*		Probability	Finished Water pH PWSs with only pH Adjustment in Place *baselineph_wph*	
	Groundwater	Surface Water		Groundwater	Surface Water
10%	6.3	6.3			
15%	6.8	6.8			
25%	7.3	7.2			
25%	7.8	7.7	75%	8.2	8.2
15%	8.3	8.3	15%	8.3	8.3
10%	8.8	8.9	10%	8.8	8.9

Acronyms: PO4 = orthophosphate; PWS = public water system.

In order to determine the cost of re-optimizing CCT or undertaking pH adjustment triggered by DSSA requirements, for model-PWSs with existing PO_4 treatment installed, the SafeWater LCR model needs an estimate of the model-PWS's baseline dose of PO_4. Using data from the Six-Year 3 Review ICR Dataset, the EPA developed a triangular distribution based on the minimum (0.05 mg/L), mode (1.4 mg/L), and maximum (4 mg/L) of reported baseline PO_4 doses. For ease of modeling CCT unit costs, the EPA limited the number of potential baseline PO_4 doses to four ranges and represented each range by its median as shown in Exhibit 4-52, columns (a), (b), and (c). Using the triangular distribution, the EPA determined the likelihood of a model-PWS having a baseline PO_4 dose in each range as shown in column (d). The EPA assumed this likelihood applied to model-PWSs serving 50,000 or fewer people with no LSLs. The EPA then assumed that these smaller systems, that have LSLs, will be less likely than same size systems without LSLs to have PO_4 doses in the lowest of the four ranges, since LSLs, when present, represent the greatest contributor of lead in a home's drinking water. A study published by the American Water Works Association (AWWA) Research Foundation ''Contributions of Service Line and Plumbing Fixtures to Lead and Copper Rule Compliance Issues'' (Sandvig et al., 2008) estimates that 50 percent to 75 percent of lead in drinking water comes from LSLs.[110] Since LSLs represent a more significant lead challenge, it is expected that systems would need higher orthophosphate doses to reduce lead levels. The EPA modeled this assumption by decreasing the likelihood of having a dose of 0.525 mg/L by 50 percent and

[110] While removal of LSLs is critical to reducing lead in drinking water, premise plumbing materials also continue to be a source of lead in drinking water (Elfland, 2010; Kimbrough, 2007; Rockey et al., 2021). In addition, premise plumbing materials can be a source of particulate lead. For example, brass particles and lead solder particles were identified as the cause of severe tap water contaminations during three field investigations in North Carolina and Washington, D.C. (Triantafyllidou and Edwards, 2012). This means that even where systems remove all LSLs, CCT must be continued because of the lead and copper sources that will remain in the premise plumbing of consumers' homes and other buildings (USEPA, 2020b), and in lead connectors. Systems without LSLs can exceed the lead action level, for example, due to the corrosion of premise plumbing containing lead.

increasing the likelihood of having the next highest dose, 1.5 mg/L, by an equivalent amount (see column (e)).

The EPA also made adjustments to implement its assumption that larger systems have a higher probability of higher doses than small systems with similar LSL status (see columns (f) and (g)), since the distribution systems are larger and more complex. Finally, the EPA assumed, for modeling purposes, that a dose of 3.2 mg/L will result in optimized CCT and that no model-PWS in the baseline has fully optimized CCT as a conservative estimate. Therefore, the likelihood of a model-PWS having a baseline dose of 3.2 mg/L is set to zero and the likelihoods of the other doses is normalized so that the sum of the percentage values equal 100 percent. The final baseline PO_4 doses, and their likelihoods, are provided in Exhibit 4-53.

Exhibit 4-52: Derivation of Baseline PO_4 Dose by System Size and LSL Status

PO_4 Dose Range Minimum (mg/L) (a)	PO_4 Dose Range Maximum (mg/L) (b)	PO_4 Dose Range Median (mg/L) (c)	Likelihood ≤50,000 people No LSL (d)	Likelihood ≤50,000 people LSL (e)	Likelihood > 50,000 people No LSL (f)	Likelihood >50,000 people LSL (g)
0.05	<1	0.525	7.9%	4.0%	4.0%	0%
≥ 1	<2	1.5	48.1%	52.1%	28.0%	32.0%
≥2	≤3.2	2.65	38.6%	38.6%	43.4%	43.4%
≥3.2	4	3.6	5.4%	5.4%	24.7%	24.7%

Exhibit 4-53: Baseline PO_4 Doses by System Size and LSL Status Used in Cost Modeling

PO_4 Dose Range Median (mg/L)	Normalized Likelihood ≤50,000 people No LSL	Normalized Likelihood ≤50,000 people LSL	Normalized Likelihood > 50,000 people No LSL	Normalized Likelihood >50,000 people LSL
0.525	8%	4%	5%	0%
1.5	51%	55%	37%	42%
2.65	41%	41%	58%	58%

4.3.3.1 CCT Installation

PWSs without CCT may be required to install CCT under the final LCRI if they exceed the lead AL.[111] Costs related to CCT installation are categorized as follows:

- Capital and operations and maintenance costs (see Section 4.3.3.1.1).
- Ancillary costs (see Section 4.3.3.1.2).

4.3.3.1.1 Capital and Operation and Maintenance CCT Installation Costs

Under the final LCRI, a PWS that installs CCT will choose among three technology options.

- Add PO_4 and pH post-treatment
- Add PO_4 and modify pH
- Modify pH

The EPA assumed that model-PWSs with a baseline pH (*baselineph_wocct*) equal to or greater than 7.2, but less than 8.4, will choose to add PO_4 and conduct pH post-treatment, while those with pH below 7.2 will choose to add PO_4 and modify pH. For model PWSs that add PO_4 with pH post-treatment, the EPA assumed that the PO_4 dose is equal to 3.2 mg/L and post-treatment will maintain the current pH level (*baselineph_wocct*).[112] For model-PWSs that add PO_4 and adjust pH, the EPA assumes the same PO_4 dose of 3.2 mg/L. In addition, the EPA assumes the model PWS will adjust their pH from their starting pH (*baselineph_wocct*) to 7.2. The EPA assumes that model-PWSs with a baseline pH greater that 8.4 will choose to modify pH and not add PO_4.

The SafeWater LCR model uses the WBS unit cost functions (see *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b), along with the entry point (EP) flow values, to calculate the capital and O&M costs for CCT installation at each entry point to the distribution system (EP). All of the WBS capital cost equations are a function of DF, and all WBS O&M costs are a function of ADF.[113] Since CCT is conducted at the model-PWS's EPs, the SafeWater LCR model calculates the DF and ADF of each EP. For all model-PWSs except some very large systems[114] (see Section 4.2.3), the EPA does not know the number of people, and hence, flow, associated with individual EPs. Therefore, in the absence of this information, the SafeWater LCR model calculates the EPs flows assuming they are equal to:

[111] EPA assumed that CWSs serving 50,000 or more people will have already installed CCT except for a very small number of "b3" systems (16), which are assumed to have naturally non-corrosive water and never be required to install CCT. The 2021 LCRR provides flexibility to CWSs serving 3,300 or fewer people and all NTNCWSs by allowing them to choose among replace all LSLs, install POU treatment, install/re-optimize CCT, or replace all lead bearing plumbing if they exceed the lead AL.

[112] The addition of PO_4 lowers pH levels so post-treatment is conducted to maintain pH levels.

[113] See Chapter 3, Section 3.3.6 for a description of how the EPA estimates PWS design and ADFs.

[114] In the case of some very large systems (VLSs), the EPA collected additional EP level data on flows and pH level (See Appendix B, Section B.2.3). The SafeWater LCR model uses these data to calculate the CCT installation and O&M costs for each EP for these VLSs.

Entry Point Design Flow = PWS Design Flow / PWS Number of EPs

Entry Point Average Daily Flow = PWS Average Daily Flow / PWS Number of EPs

The model-PWS capital and O&M cost of CCT installation at each EP is then multiplied by the number of EPs. The cost models, and their inputs, for calculating the capital and O&M cost of CCT installation are:

- PO_4 and pH post-treatment

  PO_4 dose = 3.2
  Current pH: = *baselineph_wocct*
  Ending pH = *baselineph_wocct*

- Add PO_4 and modify pH

  PO_4 dose = 3.2
  Current pH = *baselineph_woccct*
  Ending pH = 7.2

- Modify pH

  PO_4 dose = 3.2
  Current pH = *baselineph_woccct*
  Ending pH = 9.2

In addition to the capital and O&M cost of CCT installation, model-PWSs also face an ancillary CCT study cost associated with CCT installation. This cost is discussed in the next section.

4.3.3.1.2 Ancillary CCT Installation Costs

The EPA has developed system costs for an ancillary activity associated with CCT installation as shown in Exhibit 4-54. The exhibit provides the unit burden and/or cost for the activity. The assumptions used in the estimation of the unit burden and cost follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-54: PWS CCT Installation-Related Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	***SafeWater LCR Data Variable***
a) Conduct a study	<u>Study</u> • No LSLs and PWSs serving ≤ 10,000 people with LSLs (coupon testing): \$30,372 • With LSLs (harvested pipe loop testing): \$307,744 for 10,001 - 50,000 people; \$376,685 for > 50,000 people	*cost_cct_study_dem*

Acronyms: CCT = corrosion control treatment; LSL = lead service line.
Note: Activity b), "Install CCT Treatment (PO_4, PO_4 with post treatment, pH adjustment, or modify pH)" was previously discussed in Section 4.3.3.1.1.

a) ***Conduct a study (cost_cct_study_dem).*** The EPA assumed States will require all systems to conduct either harvested pipe loop testing or a coupon study prior to CCT installation. The SafeWater LCR model uses the following set of assumptions:

- Systems required to conduct a CCT study will use a contractor.
- Systems without LSLs and systems serving 10,000 or fewer people with LSLs will use a coupon study at an estimated cost of $30,372 for systems of all sizes.
- Systems with LSLs will incur a cost of $307,744 for those serving 10,001 to 50,000 people and $376,685 for those serving more than 50,000 people for harvested pipe loop testing.

The development of harvested pipe loop and coupon test study costs are detailed in *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b).

Exhibit 4-55 details how the data variables are used to estimate system ancillary activities related to CCT Installation.

Exhibit 4-55: PWS Ancillary CCT Installation Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
a) Conduct a CCT study				
Material cost per system for the marginal contractor cost, with the difference between coupon testing and harvested pipe loop testing reflected in the stratification of the data by system LSL status. *cost_cct_study_dem*	Cost applies as written to NTNCWSs.	Above AL	Model PWSs without CCT that conducts a study on CCT installation	One time

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

4.3.3.2 Re-optimization of Existing Corrosion Control Treatment

PWSs that have previously implemented CCT may be required to re-optimize their treatment if they exceed the lead AL again. Costs related to CCT re-optimization are categorized as follows:

- Capital and operations and maintenance costs (see Section 4.3.3.2.1).
- Ancillary costs (see Section 4.3.3.2.2).

4.3.3.2.1 Capital and Operation and Maintenance CCT Re-optimization Costs

Estimating the cost of existing CCT

While the EPA knows which model-PWSs currently have CCT installed, the EPA does not know which CCT technology they have installed. Therefore, when the SafeWater LCR model develops the model-PWSs, it assigns a CCT technology to each model-PWS known to have CCT in place.[115] The input parameters used in the WBS models that calculate existing CCT O&M costs for the three modeled CCT technologies, are:

- Add PO_4 with PH Post Treatment.
    - PO_4 Dose = *baselinepo4dose*
    - Starting pH: *baselineph_woph*
    - Ending pH: *baselineph_woph*

- Modify pH.
    - Starting pH: *baselineph_wph* – 0.5
    - Ending pH: pH: *baselineph_wph*

- Add PO_4 and Modify PH.
    - PO_4 Dose = *baselinepo4dose*
    - Starting pH: *baselineph_wpo4ph*- 0.5
    - Ending pH: *baselineph_wpo4ph*

Estimating the cost of re-optimizing existing CCT

The EPA assumed that if a model-PWS must re-optimize its CCT under the final LCRI, it will achieve the following standards based on its existing CCT technology (which was described above):

- Add PO_4 and pH post-treatment.
    - Increase PO_4 dose to 3.2 mg/L.
    - Maintain existing pH.

- Add PO_4 and modify pH.
    - Increase PO_4 dose of 3.2 mg/L.
    - Maintain pH at a minimum of 7.2.

- Modify pH.
    - Maintain pH at 9.2.

To calculate the cost to re-optimize CCT, the SafeWater LCR model first calculates the annual O&M cost of treating to the above assumed standards (PO_4 dose and/or pH level) as if no CCT was installed. To do so, the SafeWater LCR model uses the following parameters and WBS cost functions:

- Add PO_4 and pH post-treatment.

[115] See derivation file "Baseline CCT Characteristics.xlsx" for the baseline parameters and their likelihoods.

PO_4 Dose = 3.2 mg/L
Beginning pH = *baselineph_woph*
Ending pH = *baselineph_woph*

- Add PO_4 and modify pH.

PO_4 Dose = 3.2 mg/L
Beginning pH = *baselineph_wpo4ph*- 0.5
Ending pH = the greater of *baselineph_wpo4ph* or 7.2

- Modify pH.

Beginning pH = *baselineph_wph* -0.5
Ending pH = 9.2

The SafeWater LCR model then subtracts the model-PWS's existing CCT annual O&M cost from the new annual O&M cost to calculate the share of the model-PWS's annual CCT O&M costs attributable to the final LCRI CCT requirements. These O&M costs, combined with the annualized capital cost to retrofit the CCT system based on the new parameters, described above, equal the model PWS's total annual capital and O&M cost for CCT adjustment. The following section discusses additional ancillary costs associated with CCT adjustment.

4.3.3.2.2 Ancillary CCT Re-optimization Costs

The EPA has developed system ancillary costs for an ancillary activity associated with CCT re-optimization as shown in Exhibit 4-56. The exhibit provides the unit burden and/or cost for the activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-56: PWS CCT Ancillary Re-optimization Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	***SafeWater LCR Data Variable***
c) Revise CCT study	Systems with ALE • No LSLs and PWSs serving ≤ 10,000 people with LSLs (coupon test): \$30,372 • With LSLs (harvested pipe loop testing): \$307,744 for 10,001 - 50,000 people; \$376,685 for > 50,000 people	*cost_cct_study_dem*

Acronyms: ALE = action level exceedance, CCT = corrosion control treatment; LSL = lead service line.
Source: Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water (USEPA, 2023b).
Note: Activity d), "Re-optimize existing CCT" was previously discussed in Section 4.3.3.2.1.

c) ***Revise CCT study (cost_cct_study_dem).*** The EPA assumed States will require all systems to conduct a study prior to CCT re-optimization.

- Systems will use a contractor to conduct a study.

- Systems with an ALE will conduct a demonstration study (*cost_cct_study_dem*). Specifically, systems:
    - Without LSLs and systems serving 10,000 or fewer people with LSLs will do a coupon study at an estimated cost of $30,372 for all sizes.
    - With LSLs will do a harvested pipe loop at an estimated cost of $307,744 for systems serving 10,001 to 50,000 people and $376,685 for those serving more than 50,000 people.

The development of harvested pipe loop and coupon test study costs are detailed in *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b).

Exhibit 4-57 shows the SafeWater LCR model cost estimation approach for system ancillary CCT re-optimization study activities including additional cost inputs required to calculate these costs.

Exhibit 4-57: PWS CCT Ancillary Re-optimization Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
c) Revise CCT study				
Material cost per system for the marginal contractor cost, with the difference between coupon testing and harvested pipe loop testing reflected in the stratification of the data by system LSL status. *cost_cct_study_dem*	Cost applies as written to NTNCWSs.	Above AL	Model PWS re-optimizing CCT	One time

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

4.3.3.3 DSSA Costs

Under the final LCRI, PWSs must take DSSA corrective actions whenever an individual lead tap water sample exceeds 10 µg/L. The likelihood that a sample would exceed 10 µg/L is provided in Exhibit 4-58 with the corresponding SafeWater input names shown in red.

Exhibit 4-58: Likelihood of an Individual Lead Sample Result Above 10 µg/L

LSL Status	P90 >15 µg/L	12 µg/L < P90 ≤ 15 µg/L	10 µg/L < P90 ≤ 12 µg/L	5 µg/L < P90 ≤ 10 µg/L	P90 ≤ 5 µg/L
	pp90above al10_1	*pp90above al10_2*	*pp90above al10_3*	*pp90above al10_4*	*pp90above al10_5*
Has LSLs	25.2%	16.8%	13.8%	6.5%	1.8%
No LSLs	22.2%	23.1%	21.1%	6.5%	0.5%

Acronyms: ALE = action level exceedance; LSL = lead service line.
Source: Likelihood_Sample_Above_AL_LCRI_DSSA_Final.xlsx.
Note: This information also is provided as Exhibit 3-33 in Chapter 3.

The EPA assumed in the SafeWater LCR model that in response to individual lead tap water samples above 10 µg/L, model-PWSs will take progressively more stringent corrective actions. These assumed actions are:

1. First sampling period with one or more individual tap water samples above 10 µg/L – model-PWS will investigate the cause but not take any corrective action.
2. Second sampling period with one or more individual tap water samples above 10 µg/L – model-PWS will perform spot flushing once in the distribution system.
3. Third sampling period with one or more individual tap water samples above 10 µg/L – model-PWS will increase the pH level at one EP.
4. Fourth sampling period with one or more individual tap water samples above 10 µg/L – model-PWS will increase the pH at all other EPs (if more than one).

These corrective actions are not meant to encompass the entire suite of DSSA compliance options but rather provide a representation of typical actions a PWS might take to correct reoccurring individual lead tap samples over 10 µg/L.

4.3.3.3.1 Cost of Spot Flushing an Entry Point

In response to a second sampling period with at least one lead tap sample greater than 10 µg/L, the EPA assumed, in the Safe Water LCR model, that systems will perform spot flushing. Spot flushing involves crews opening hydrants in the area of the tap monitoring result to bring in fresh water and eliminate potential issues with elevated water age, which could cause the water to be more corrosive. The assumptions for spot flushing are consistent with the *Technology and Cost Document for the Revised Total Coliform Rule* (USEPA, 2012b). See Exhibit 4-59 for the PWS unit burden and cost for spot flushing with detailed assumptions in the notes.

Exhibit 4-59: PWS Burden and Cost to Flush as DSSA Response (2020$)

System Size (Population Served)	Burden (hrs per system) (*hrs_flush_wqp_op*)	Cost ($ per system) (*cost_flush_wqp*)
	A	B
≤1,000	4	$131.03
1,001-3,300	4	$195.89
3,301-50,000	8	$195.89
>50,000	8	$260.75

Source: *Technology and Cost Document for the Revised Total Coliform Rule* (USEPA, 2012b; "Likelihood_Sample_Above_AL_LCRI_DSSA_Final.xlsx"). Costs have been updated to 2020$.
Notes:
A: Assumes that each spot flushing response is a one-half day event. Assumes 1-person crew for systems serving 3,300 or fewer people and 2-person crew for those serving > 3,300 people.
B: Estimate is based on value of flushed water and cost of flushed water disposal, *i.e.*, dichlorination. Where LCRI system size categories do not match those used in the technology and cost document for the *Revised Total Coliform Rule* (RTCR), the EPA used the closest category.

4.3.3.3.2 Cost of pH Adjustment

In response to a third sampling period with at least one lead tap sample greater than 10 µg/L, the EPA assumed, in the Safe Water LCR model, that a model-PWS will increase its pH at one EP if it has optimized CCT in place. The EPA assumed the model-PWS will achieve the following standards:

- If model-PWS has used PO_4 for its corrosion inhibitor, then the system will maintain its pH at a minimum of 7.5 instead of 7.2.
- If a model-PWS modified pH for corrosion control, it will maintain its pH at 9.4 instead of 9.2.

To calculate the cost to increase pH in response to individual tap samples above 10 µg/L, the SafeWater LCR model first calculates the total annual O&M cost for treating to the DSSA standards listed above as if no CCT was installed. The SafeWater LCR model also calculates the capital cost to retrofit the CCT system for additional pH adjustment. To do so, the SafeWater LCR model uses the following parameters and WBS cost functions:

- If the model-PWS has PO_4 treatment installed and its *baselineph_woph* < 7.5:
  Add PO_4 and Modify pH
  PO_4 Dose = 3.2
  Starting pH: *baselineph_woph*
  Ending pH: 7.5

- If the model-PWS has PO_4 treatment installed and its *baselineph_woph* ≥ 7.5:
  Add PO_4 with pH Post Treatment
  PO_4 Dose = 3.2
  Starting pH: *baselineph_woph*
  Ending pH: *baselineph_woph*

- If the model-PWS has pH adjustment installed:
  Modify pH

Starting pH: = *baselineph_woph* – 0.5
Ending pH: 9.4

The SafeWater LCR model then subtracts the model-PWS's current CCT annual O&M cost from the new DSSA annual O&M cost to calculate the share of model-PWS's annual CCT O&M costs attributable to DSSA actions. These O&M costs combined with the annualized capital cost to retrofit the CCT system based on the new parameters, described above, equal the model-PWS's total annual capital and O&M cost of DSSA. Additional ancillary costs associated with DSSA are discussed in the following section.

In the fourth sampling period with one or more individual tap water samples above 10 µg/L, the model-PWS will increase the pH at all other EPs (if the model-PWS has more than one EP). This calculation is the same as described for the Year 3 DSSA pH adjustment except that the calculation is made for all entry points.

4.3.3.3.3 Ancillary DSSA Costs

The EPA developed ancillary costs associated with a system's DSSA responses to a lead tap result above 10 µg/L as shown in Exhibit 4-60. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the State instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 4-60: PWS Ancillary DSSA Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
e) Contact customers and collect follow-up tap sample	Burden per sample CWSs: 3.4 to 3.7 hrs NTNCWSs: 0.5 hrs Costs per sample CWSs: $5.75 to $13.09 NTNCWSs: $0	Burden *hrs_samp_above_al_op* Cost *cost_samp_above_al*
f) Analyze follow-up lead tap sample	In-house Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample Cost: $3.92 Commercial Analysis $32.20	In-house Analysis *hrs_analyze_samp_op*[1] *cost_lab_lt_samp*[1] Commercial Analysis *cost_commercial_lab*[1]

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
g) Collect distribution system WQP sample	Burden per sample per PWS with CCT 0.5 hrs Cost for per sample per PWS with CCT pH adjustment: • $1.70 to $2.66 (CWS); • $2.66 (NTNCWS) Orthophosphate: • $0.63 to $1.07 (CWS) • $2.66 (NTNCWS)	Burden *hrs_wqp_dssa_op* Cost pH: *cost_wqp_material_ph* Orthophosphate: *cost_wqp_material_ortho*
h) Analyze distribution system WQP sample	In-House Burden per sample per PWS with CCT pH adjustment: • 0.15 to 0.46 hrs (CWS) • 0.15 hrs (NTNCWS) Orthophosphate: • 0.15 to 1.34 hrs (CWS) • 0.15 hrs (NTNCWS) In-House cost per sample per PWS with CCT pH adjustment: • $0.63 to $0.98 (CWS) • $0.63 (NTNCWS) Orthophosphate: • $0.63 to $1.07 (CWS) • $0.63 (NTNCWS) Commercial cost per sample per PWS with CCT pH adjustment: $27.24 to 30.55 (CWS & NTNCWS) Orthophosphate: $60.34 to $61.89 (CWS & NTNCWS)	In-House Burden pH adjustment: *hrs_wqp_analyze_ph_op* Orthophosphate: *hrs_wqp_analyze_ortho_op* In-House Cost pH adjustment: *cost_wqp_ph_analyze* Orthophosphate: *cost_wqp_ortho_analyze* Commercial Cost pH: *cost_lab_ph_wqp* Orthophosphate: *cost_lab_ortho_wqp*
i) Review incidents of systemwide event and other system conditions	CWSs: 4 to 30 hrs/system NTNCWSs: 1 to 14 hrs/system	*hrs_deter_dssa_op*
j) Consult with the State prior to making CCT changes	2 hrs per system with CCT	*hrs_consult_dssa_op*
k) Report follow-up sample results and overall DSSA responses to the State	2 hrs/PWS serving ≤ 50,000 people; 4 hrs/PWS serving > 50,000 people	*hrs_report_dssa_op*

Acronyms: CCT = corrosion control treatment; CWS = community water system; DSSA = Distribution System and Site Assessment; NTNCWS = non-transient non-community water system; PWS = public water system; WQP = water quality parameter.
Sources: Data sources for each activity are provided following this exhibit.
Note:

[1] In Arkansas, Louisiana, Mississippi, Missouri, and South Carolina, the State pays for the cost of bottles, shipping, analysis, and providing sample results to the system (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities in lieu of the system.

e) ***Contact customers and collect follow-up tap samples (hrs_samp_above_al_op, cost_samp_above_al)***. CWSs and NTNCWSs will incur burden and costs to contact customers and collect a follow-up tap sample at each compliance sampling location[116] that had a result above 10 µg/L. Exhibit 4-58 in Section 4.3.3.3 provides the likelihood a system will have a single sample above 10 µg/L for each of the five lead 90th percentile classifications. Also refer to Chapter 3, Section 3.3.5.3 for a detailed discussion of the EPA's approach for developing these percentages. For modeling purposes, the EPA assumed all customers would respond to the water system and agree to have a follow-up sample collected.

Exhibit 4-61 provides the burden or labor associated with these activities for CWSs and Exhibit 4-62 provides the associated costs. Burden and cost estimates for NTNCWSs follow the exhibits.

Note that the required notification to the customer of the original sample result above 10 µg/L that triggered the additional sampling is captured under the Lead Tap Sampling Costs using *hrs_inform_samp_op* and *cost_cust_lt* for CWSs and *hrs_NTNCWS_inform_samp_op* and *cost_NTNCWS_inform_lt for NTNCWSs.* See Section 4.3.2.1.2, activity m).

Exhibit 4-61: Burden (hours) for CWSs to Contact Customers and Collect Tap Samples for Locations with a Lead Tap Sample > 10 µg/L (hrs_samp_above_al_op)

System Size (Population Served)	Phone Call	Site Visit			Total
		Travel (Round-Trip)	Look for Lead Sources	Sample Collection	
	A	B	C	D	E=A:D
≤100,000	0.5	0.40	2	0.5	**3.4**
100,001-1,000,000	0.5	0.51	2	0.5	**3.5**
>1,000,000	0.5	0.71	2	0.5	**3.7**

Source: "Likelihood_Sample_Above_AL_DSSA_LCRI_Final.xlsx."
Notes:
General: This requirement applies to all CWSs that have any sample > 10 µg/L.
A: Assumed systems would spend 0.5 hours to contact customer to coordinate site visit and to discuss possible causes of the high tap sample value.
B: Based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 5.0 miles for those serving ≤ 100,000 people, 6.4 miles for those serving 100,001 – 1,000,000, and 8.9 miles for those serving > 1,000,000. See file, "Estimated Driving Distances_Final.xlsx," available in the docket under EPA-HQ-OW-2022-0801 at www.regulations.gov," for additional detail. The EPA assumed an average speed of 25 miles per hour and two times distance for round-trip travel.
C: Assumed systems will spend 2 hours on average to look for lead sources in premise plumbing and service line.

[116] Some systems conduct free lead testing at the request of the customer. The EPA encourages, but does not require, systems to conduct DSSA activities if a customer requested tap sample result exceeds 10 µg/L.

D: Assumed same burden as used for systems to collect a lead and copper source water sample, see Section 4.3.2.4.2, activity ff) for detail.

Exhibit 4-62: Costs for CWSs to Contact Customers and Collect Tap Samples for Locations with a Lead Tap Sample > 10 µg/L (cost_samp_above_al)

System Size (Population Served)	Phone Call	Site Visit			Total
		Travel (Round-Trip)	Look for Lead Sources	Sample Collection	
	A	B	C	D	E=A:D
≤100,000	$0.00	$5.75	$0.00	$0.00	**$5.75**
100,001-1,000,000	$0.00	$7.36	$0.00	$2.85	**$10.21**
>1,000,000	$0.00	$10.24	$0.00	$2.85	**$13.09**

Source: "Likelihood_Sample_Above_AL_LCRI_DSSA_Final.xlsx."
Notes:
General: This requirement applies to all CWSs that have any sample > 10 µg/L.
A&C: Assumed to have no non-labor costs.
B: Based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 5.0 miles for those serving ≤ 100,000 people, 6.4 miles for those serving 100,001 – 1,000,000, and 8.9 miles for those serving > 1,000,000. See file, "Estimated Driving Distances_Final.xlsx," available in the docket under EPA-HQ-OW-2022-0801 at www.regulations.gov," for additional detail. Assumed cost of $.5754 per mile using the 2020 reimbursement from https://www.gsa.gov/travel/plan-book/transportation-airfare-pov-etc/privately-owned-vehicle-mileage-rates/pov-mileage-rates-archived#auto. Accessed 1/17/2022.
D: Based on information from laboratories, only CWSs serving > 100,000 people are assumed to conduct in-house analyses for lead whereas those serving ≤ 100,000 people will use a commercial lab and bottles are supplied by the commercial lab. The average cost of a 1-liter wide mouth bottle assuming a bulk discount rate based on six sources is $2.85. See "Lead_WQP_Sample Bottle Costs," worksheet "Average Bottle Costs" for additional information.

NTNCWSs will also be required to collect a follow-up sample but will incur a different burden and cost from CWSs because they do not serve homeowners and thus, are not required to conduct a separate site visit. The EPA assumed NTNCWSs will incur a burden 0.5 hours per follow-up sample (*hrs_samp_above_al_op*), which is the same burden as that used to collect a lead and copper source water sample and is based on the *2022 Disinfectants and Disinfection Byproducts, Chemical, and Radionuclides Rules ICR*, Exhibit 15 (USEPA, 2022a). In addition, NTNCWSs will incur no bottle costs to collect the sample because the EPA assumed all NTNCWSs will use a commercial lab in which bottles are included as part of the laboratory fee. Thus, *cost_samp_above_al* is $0.

f) Analyze follow-up tap samples (hrs_analyze_samp_op, cost_lab_lt_samp, cost_commercial_lab). As previously presented in Section 4.3.2.1.2, activity k), the EPA assumed CWSs serving more than 100,000 people will conduct lead analyses in-house and require 0.44 hours per sample based on estimates provided by three laboratories (*hrs_analyze_samp_op*). These systems will also incur consumable costs of $3.92 per sample based on information from three vendors (*cost_lab_lt_samp*). The remaining CWSs and all NTNCWSs are assumed to use a commercial laboratory and incur a cost to ship the sample to the lab of $8.70 and an analytical cost of $23.50 per lead sample analysis based on quotes from seven laboratories for a total per sample cost of $32.20

(*cost_commercial_lab*). See “Lead Analytical Burden and Costs_Final.xlsx,” worksheet “Tap_ Collect_Analyze_CWS_LCRI” for additional information.

g) ***Collect distribution system WQP sample (hrs_wqp_dssa_op, cost_wqp_material_ph, cost_wqp_material_ortho).*** Systems with CCT must collect one distribution sample at or near the site where the high lead sample was collected within five days of learning of the lead results. Thus, the EPA assumed the timing of this monitoring may not coincide with their Total Coliform Rule (TCR) samples and systems would incur a burden of 0.5 hours to collect the WQP sample (*hrs_wqp_dssa_op*). The EPA uses the same SafeWater LCR model data variables and input values for the burden and cost associated with WQP distribution system sample collection as described in Section 4.3.2.2.4 and Exhibit 4-21 (CWSs) and Exhibit 4-22 (NTNCWSs) for this activity.

If an existing WQP site does not meet these criteria, the system must identify a new monitoring site. Only systems with CCT must use the new site for future WQP distribution system sampling. The EPA has capped the additional number of WQP sample sites that must be added in response to DSSA investigations to twice the standard number of required WQP sample sites. For example, as discussed in Section 4.3.2.2.3, systems serving 10,001 to 50,000 people must conduct monitoring from 10 sites if they are on standard monitoring (*numb_enhance_wqp*). For DSSA distribution monitoring, no more than 10 additional sites would be added for systems on standard or reduced monitoring.[117]

For CWSs, the EPA estimated the likelihood a WQP site will need to be added (*pp_overlap_dssa*) in Exhibit 4-63. This likelihood is used to determine the number of sites added to a CWS’s WQP sample collection and analysis each year *(numb_wqp_sites_added)*. NTNCWSs have limited distribution systems and the EPA assumed these systems with CCT will not add new WQP sites.

Exhibit 4-63: Likelihood a CWS Will Add a WQP Sampling Site in Response to the DSSA

System Size (Population Served)	Tap Samples sites (standard number)	WQP sites (standard number)	Percent of WQPs compared to Tap Sites	Likelihood a CWS will add a WQP site *pp_overlap_dssa*
	A	B	C = B/A*100	D
≤100	5	1	20.0%	0.0%
101-500	10	1	10.0%	0.0%
501-1,000	20	2	10.0%	0.0%
1,001-3,300	20	2	10.0%	20.0%
3,301-10,000	40	3	7.5%	20.0%

[117] Systems subject to lead or copper WQP monitoring as discussed in Sections 4.3.2.2 and 4.3.2.3, respectively, must collect two samples from the number of sites specified in the rule. As discussed in Section 4.3.2.2.3, *numb_enhance_wqp* represents the standard number of WQP tap samples that must be collected at each site for systems on standard monitoring. In the SafeWater LCR model, ½ *numb_enhance_wqp* represents the maximum number of samples that could be added under the DSSA requirements for systems with CCT because only one sample would be required at each site. This applies to systems with CCT on standard or reduced WQP tap monitoring.

System Size (Population Served)	Tap Samples sites (standard number)	WQP sites (standard number)	Percent of WQPs compared to Tap Sites	Likelihood a CWS will add a WQP site *pp_overlap_dssa*
	A	B	C = B/A*100	D
10,001-100,000	60	10	16.7%	20.0%
>100,000	100	25	25.0%	10.0%

Source: "Likelihood_Sample_Above_AL_LCRI_DSSA_Final.xlsx."

Notes:

A: See Exhibit 4-9.

B: See Exhibit 4-19.

D: The EPA assumed for CWSs with CCT serving:

- ≤1,000 people, the distribution system is not extensive and the WQP sampling location would be at or near the sampling site with the lead result above 10 µg/L. Thus, these systems would have a zero likelihood of adding a new WQP site.
- > 1,000 people, the EPA divided the minimum required number of WQP sites (Column B) by the number of tap sites (Column A). The EPA assumed the higher the ratio, the more likely a system would be to have a WQP sampling site at or near a required tap sampling site with lead values greater than 10 µg/L and the lower the likelihood a system would add a new WQP sampling site. Specifically, the EPA assumed those with a ratio of ≤ 20 percent (those serving 1,001 - 100,000 people) would have a 0.2 likelihood of adding a new WQP site. The EPA assumed those with a ratio of > 20 percent would have a lower likelihood of 0.1 of adding a new WQP site (those serving > 100,000 people).

h) ***Analyze distribution system WQP sample (hrs_wqp_analyze_ph_op, hrs_wqp_analyze_ortho_op, cost_wqp_ph_analyze, cost_wqp_ortho_analyze, cost_lab_ph_wqp, cost_lab_ortho_wqp).*** Systems with CCT must collect the same WQPs as discussed in Section 4.3.2.2.4 for lead WQP monitoring. Specifically, systems using pH adjustment must sample for pH and alkalinity, those using orthophosphate treatment must sample for pH, alkalinity, and orthophosphate. Thus, the EPA used the same SafeWater LCR model data variables and input values for WQP sample analysis as described in Section 4.3.2.2.4 for lead WQP monitoring. See Exhibit 4-23 and Exhibit 4-24 for the analytical burden for CWSs and NTNCWSs to conduct in-house analyses, respectively (*hrs_wqp_analyze_ph_op*, *hrs_wqp_analyze_ortho_op*). See Exhibit 4-25 and Exhibit 4-26 for the in-house analytical costs for CWSs and NTNCWSs, respectively (*cost_wqp_ph_analyze*, *cost_wqp_ortho_analyze*). See Exhibit 4-27 and Exhibit 4-28 for the commercial costs per sample for CWSs and NTNCWSs, respectively (*cost_lab_ph_wqp*, *cost_lab_ortho_wqp*).

i) ***Review incidents of systemwide events and other system conditions (hrs_deter_dssa_op).*** Under the final LCRI, systems must determine if a CCT change is needed following lead tap sample result(s) above 10 µg/L. For the purposes of this cost analysis, the EPA assumed that systems will assess distribution system operations and determine if there could have been factors that contributed to deteriorating water quality and elevated lead levels. Exhibit 4-64 provides the estimated burden for CWSs and NTNCWSs to conduct this assessment. The estimates are based on comparable activities and burden estimates for CWSs and NTNCWSs to conduct level 1 assessments following non-acute TCR violations. Additional detail on the derivation of these burdens is provided in "Likelihood _Sample_Above_AL_LCRI_DSSA_Final.xlsx," in worksheet, "Distribution_System_Assessment."

Exhibit 4-64: PWS Burden to Conduct Distribution System Assessment

System Size (Population Served)	CWS Burden to Conduct Assessment (hrs/system)	NTNCWS Burden to Conduct Assessment (hrs/system)
	hrs_deter_dssa_op	
≤1,000	4	1
1,001-3,300	6	1
3,301-10,000	8	4
10,001-50,000	10	5
50,001-100,000	13	6
>100,000	30	14

Source: *Technology and Cost Document for the Final Revised Total Coliform Rule* (USEPA, 2012b); *Economic Analysis for the Final Revised Total Coliform Rule* (USEPA, 2012a) (available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov). Derived in "Likelihood_Sample_Above_AL_LCRI_DSSA_Final.xlsx," worksheet, "Distribution_System_Assessment."

j) ***Consult with the State prior to making CCT changes (hrs_consult_dssa_op).*** Systems with CCT that have at least one sample > 10 µg/L must consult with their State prior to making any CCT changes. The EPA assumed a 2 hour consultation burden that is consistent with other types of consultations and is based on the estimated burden for systems to consult with their State on public education activities from pg. 60 of the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule (USEPA, 2007).

k) ***Report follow-up sample results and overall DSSA responses to the State (hrs_report_dssa_op).*** PWSs will incur burden to provide the results of tap and WQP monitoring results, and any distribution system management actions or CCT adjustments made to fix the cause of sample results above 10 µg/L to their State. The EPA assumed the systems will require 2 hours and 4 hours to prepare the annual report for systems serving 50,000 or fewer and those serving more than 50,000 people, respectively. The EPA assumed systems would not incur a separate cost for generating a physical report because systems would provide this information electronically to their State. Systems must also provide this information to the health departments. The EPA assumed that systems would incorporate the DSSA results into a larger report that includes outreach information and school sampling results (CWSs only). The burden and material cost of the report is captured under the cost to distribute the outreach, which corresponds to data inputs *hrs_hc_op* and *cost_hc*. See Section 4.3.6.2, activity l).

Exhibit 4-65 provides the SafeWater LCR model cost estimation approach for system ancillary DSSA activities including additional cost inputs that are required to calculate the total costs.

Exhibit 4-65: PWS Ancillary DSSA Cost Estimation in SafeWater LCR by Activity[1,2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range	Other Conditions	
e) Contact customers and collect follow-up tap samples[3]				
The number of required samples per system above the AL multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(pp_above_al_bin_three*numb_samp_customer)*((hrs_samp_above_al_op*rate_op)+cost_samp_above_al)*	Cost applies as written to NTNCWSs.	At or below AL	PWSs not on reduced tap sampling and not doing POU sampling 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
			PWSs on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
The number of required samples per system above the AL multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(pp_above_al_bin_three*numb_reduced_tap)*((hrs_samp_above_al_op*rate_op)+cost_samp_above_al)*			PWSs on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
The number of required samples per system above the AL multiplied by the total of the hours per sample times the system labor rate, plus the cost of materials per sample. *(pp_above_al_bin_one*numb_samp_customer)*((hrs_samp_above_al_op*rate_op)+cost_samp_above_al)*	Cost applies as written to NTNCWSs.	Above AL	All PWSs with at least one sample > 10 µg/L	Twice a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range	Other Conditions	
f) Analyze follow-up lead tap sample[3]				
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((pp_above_al_bin_three*numb_samp_customer)*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((pp_above_al_bin_three*numb_samp_customer)*pp_commercial_samp)*cost_commercial_lab)*	Cost applies as written to NTNCWSs.	At or below AL	PWSs is not on reduced tap sampling and not doing POU sampling 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
			PWSs on annual reduced tap sampling and not doing POU sampling *p_tap_annual*	Once a year
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((pp_above_al_bin_three*numb_reduced_tap)*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((pp_above_al_bin_three*numb_reduced_tap)*pp_commercial_samp)*cost_commercial_lab)*			PWSs on triennial reduced tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((pp_above_al_bin_one*numb_samp_customer)*pp_lab_samp)*((hrs_analyze_samp_op*rate_op)+cost_lab_lt_samp))+(((pp_above_al_bin_one*numb_samp_customer)*pp_commercial_samp)*cost_commercial_lab)*	Cost applies as written to NTNCWSs.	Above AL	All PWSs with at least one sample > 10 µg/L	Twice a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range	Other Conditions	
g) Collect distribution system WQP sample				
The number of required samples per system above the AL multiplied by the total of hours per sample times the system labor rate, plus the material cost per sample. A system with CCT only needs to collect an additional WQP monitoring sample if there is not existing WQP monitoring done near the site of the above the AL tap sample. *numb_wqp_sites_added *((hrs_wqp_dssa_op*rate_op)+cost_wqp_material_ph)*	Cost does not apply to NTNCWSs.	All	PWSs with existing CCT of pH and not doing POU sampling *pbaseph*	Once per event
The number of required samples per system above the AL multiplied by the total of hours per sample times the system labor rate, plus the material cost per sample. A system with CCT only needs to collect an additional WQP monitoring sample if there is not existing WQP monitoring done at or near the site of the above the AL tap sample. *numb_wqp_sites_added*((hrs_wqp_dssa_op*rate_op)+cost_wqp_material_ortho)*	Cost does not apply to NTNCWSs.	All	PWSs with existing CCT of PO_4 or both PO_4 and pH adjustment and not doing POU sampling *pbasepo4, pbasephpo4,*	Once per event
h) Analyze distribution system WQP sample				
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. A system with CCT only needs to collect an additional WQP monitoring sample if there is not existing WQP monitoring done near the site of the above the AL tap sample. *((numb_wqp_sites_added*pp_lab_samp)*((hrs_wqp_analyze_ph_op*rate_op)+cost_wqp_ph_analyze))+((numb_wqp_sites_added*pp_commercial_samp)*cost_lab_ph_wqp)*	Cost does not apply to NTNCWS	All	PWS with existing CCT of pH and not doing POU sampling *pbaseph*	Once per event

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range	Other Conditions	
The number of samples multiplied by the likelihoods for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. A system with CCT only needs to collect an additional WQP monitoring sample if there is not existing WQP monitoring done near the site of the above the AL tap sample. *((numb_wqp_sites_added*pp_lab_samp)*((hrs_wqp_analyze_ortho_op*rate_op)+cost_wqp_ortho_analyze))+((numb_wqp_sites_added*pp_commercial_samp)*cost_lab_ortho_wqp)*	Cost does not apply to NTNCWS	All	PWSs with existing CCT of PO_4 or both PO_4 and pH adjustment and not doing POU sampling *pbasepo4, pbasephpo4*	Once per event
i) Review incidents of systemwide event and other system conditions				
The labor hours for review per system multiplied by the system labor rate. *(hrs_deter_dssa_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All PWSs with at least one sample > 10 µg/L	Once per event
j) Consult with the State prior to making CCT changes				
The labor hours per system multiplied by the system labor *(hrs_consult_dssa_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All PWSs where a second sampling period has at least one sample > 10 µg/L	Once per event
k) Report follow-up sample results and overall DSSA responses to the State				
Hours for reporting multiplied by the system labor rate. *(hrs_report_dssa_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All PWSs with at least one sample > 10 µg/L	Once per event

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PO_4 = orthophosphate; POU = point-of-use; PWS = public water system; WQP = water quality parameter.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *pbaseph, pbasepo4, and pbasephpo4:* Likelihood system has pH adjustment, orthophosphate, or pH adjustment and orthophosphate for their CCT (Section 4.3.2.2.1).

- *pp_lab_samp* and *pp_commercial_samp*: Likelihood that system will use in-house laboratory or commercial laboratory, respectively (Section 4.3.2.1.2).
- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] Systems on 9-year monitoring schedules cannot have any lead or copper in their entire distribution system including all buildings they serve and thus, none should have any samples above 10 µg/L and be subject to distribution system and site assessment requirements.

[3] The burden and costs to provide sample bottles (*cost_samp_above_al*) under activity e) and conduct analyses under activity f) are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina (ASDWA, 2020a).

4.3.3.4 System Lead CCT Routine Costs

The EPA developed routine costs associated with CCT as shown in Exhibit 4-66. The exhibit provides the unit burden each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-66: PWS CCT Routine Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
l) Review CCT guidance	• 1 hr/system with CCT serving > 50K/update[1]	*hrs_rev_cct_op*
m) Provide WQP data to the State and discuss during sanitary survey	• 1.5 to 3 hrs/system with CCT per sanitary survey[2]	*hrs_sanit_surv_op*
n) Notify and consult with the State if CCT actions are required in response to source water change	• 10 to 22 hrs/system on reduced tap monitoring • 6 to 12 hrs/system on standard tap monitoring	*hrs_coop_source_chng_red_op* *hrs_coop_source_chng_rout_op*
o) Notify and consult with the State if CCT actions are required in response to treatment change	46 to 84 hrs/system	*hrs_coop_treat_chng_op*

Acronyms: CCT = corrosion control treatment; WQP = water quality parameters.
Sources:
[1]Frequency of CCT guidance updates is assumed to be every 5 years.
[2]Sanitary surveys are conducted at least every 5 years for NTNCWSs and every 3 years for CWSs except where ground water CWSs meet special performance criteria and are permitted to conduct sanitary surveys every 5 years *(p_spec_req)*.
l) & m): "CCT Study and Review Costs_Final.xlsx."
n): "Likelihood_SourceChange_Final.xlsx."
o): "Likelihood_TreatmentChange_Final.xlsx;" ASDWA, 2024.
Note:
o): For the proposed LCRI EA, the EPA assumed a different burden for systems on standard and reduced monitoring. For the final LCRI EA, the EPA used estimates from the ASDWA 2024 CoSTS model (ASDWA, 2024) and assumed systems and States would incur the same burden to provide a report and conduct a review, respectively, regardless of the system's monitoring schedule.

l) ***Review CCT guidance (hrs_rev_cct_op).*** The EPA assumed that States will review new guidance and determine applicability for systems serving 50,000 or fewer people.[118] However, the EPA assumed that systems serving more than 50,000 people will review the new CCT guidance themselves to determine if CCT adjustment is needed and spend 1 hour on this review. The EPA assumed a relatively small burden because the revised guidance is expected to include an executive summary that can be used by large systems to quickly assess if new information is applicable to their system. The EPA also assumed that the burden for systems to discuss updated guidance with the State is

[118] See data input *hrs_cct_review_js* in Section 4.4.3.4, activity g).

already accounted for in the estimated burden to review CCT during the sanitary survey *(hrs_sanit_surv_op)*. See activity m) below.

m) ***Provide WQP data to the State and discuss during sanitary survey (hrs_sanit_surv_op).*** Systems will incur burden to gather and submit non-compliance data (*e.g.*, process control data, other WQP data) and meet with their State during the sanitary survey to determine if CCT is still optimized. The EPA assumed that documents are submitted electronically or provided on-site. The EPA assume 0.5 – 2 hours depending on system size for gathering and submitting data to the State, and 1 hour to discuss this information as well as any relevant updated CCT guidance during the sanitary survey, as shown in Exhibit 4-67.

Exhibit 4-67: Estimated PWS Burden to Gather Data and Review CCT-Related Data during Sanitary Survey to Determine if CCT Is Still Optimized

System Size (Population Served)	*SafeWater LCR Data Variable: hrs_sanit_surv_op*
≤1,000	1.5
1,001-10,000	2.0
10,001-100,000	2.5
>100,000	3.0

Source: “CCT Study and Review Costs_Final.xlsx.

In addition to the unit costs, the SafeWater LCR model requires the frequency of the sanitary survey as an input to calculate total costs for this activity. The required frequency of sanitary surveys is based on system size and water type as follows:

- The minimum frequency for all NTNCWSs is once every 5 years.
- The minimum frequency for surface water CWSs is once every 3 years.
- The minimum frequency for ground water CWSs is 3 years but can be extended to 5 years if systems provide 4-log treatment of viruses (using inactivation, removal, or a State-approved combination of these technologies) before or at the first customer or have an outstanding performance record (*e.g.*, past sanitary surveys with no significant deficiencies).

To determine the percent of ground water systems that meet the criteria for a minimum frequency of 5 years (*p_spec_req*), the EPA used Exhibits 4.2 and 4.3 from the *Economic Analysis for the Final Ground Water Rule* (USEPA, 2006a) that provide information on the estimated percentage of ground water systems meeting the 4-log removal criteria. These estimates are presented in Exhibit 4-68. These may be an underestimation because this approach does not capture systems with outstanding performance that would also qualify for a 5-year sanitary survey frequency.

Exhibit 4-68: Estimated Percent of Ground Water CWSs Achieving 4-log Virus Inactivation

System Size (Population Served)	Data from the *Economic Analysis for the Final Ground Water Rule* (USEPA, 2006a)			Estimated GW CWSs getting 4-Log In at all Entry Points	**Percent of GW CWSs getting 4-log** (*p_spec_req*)
	Total No. of GW CWSs	Total No. of Entry Points with 4-log Inactivation	Average No. of Entry points per system		
	A	B	C	D = B/C	**E = D/A**
≤100	12,843	3,996	1.3	3,074	**23.9%**
101-500	14,358	8,873	1.6	5,546	**38.6%**
501-1,000	4,649	3,547	2	1,774	**38.2%**
1,001-3,300	5,910	5,378	2.4	2,241	**37.9%**
3,301-10,000	2,884	3,547	3.2	1,108	**38.4%**
10,001-50,000	1,445	3,856	5.6	689	**47.7%**
50,001-100,000	168	583	11.3	52	**31.0%**
100,001-1,000,000	103	545	12.4	44	**42.7%**
> 1,000,000	3	34	11.4	3	**100.0%**
Total	42,363	30,359		14,531	34.3%

Acronyms: CWS = community water system; GW = ground water.
Source: "CCT Study and Review Costs_Final.xlsx."
Notes:
A: *Economic Analysis for the Final Ground Water Rule*, Exhibit 4.2, Columns F plus K (USEPA, 2006a).
B: *Economic Analysis for the Final Ground Water Rule*, Exhibit 4.3, Column H (USEPA, 2006a).
C: *Economic Analysis for the Final Ground Water Rule*, Exhibit 4.3, Column A (USEPA, 2006a).
D: Assumed that systems that provide 4-log inactivation do so at all entry points in their system, and these systems have the same number of entry points as other systems.

n) Notify and consult with the State on required actions in response to source water change (hrs_coop_source_chng_red_op, hrs_coop_source_chng_rout_op). Systems are required to seek prior approval before making any source water changes and to consult with the State on needed responses including the possibility of CCT installation. The likelihood of a system changing source (*p_source_chng*) is discussed in Chapter 3, Section 3.3.9.1 with estimated percentages for CWSs and NTNCWSs presented in Exhibit 3-53 and Exhibit 3-54, respectively. Exhibit 4-69 below provides the estimated system burden to report the source change and consult with the State for systems on reduced and standard tap monitoring. Note that the EPA estimated fewer hours for consultation for systems on standard monitoring because they are in more frequent contact with the State compared to those on reduced monitoring.

Exhibit 4-69: Estimated Hours per System to Report and Consult on Source Water Change

Hours for systems on *reduced* monitoring to report a source change (hrs_coop_source_chng_red_op)			Hours for systems on standard monitoring to report a source change (hrs_coop_source_chng_rout_op)		
A			B		
Minimum	**Maximum**	**Most Likely**	**Minimum**	**Maximum**	**Most Likely**
10	22	10	6	12	6

Source: "Likelihood_SourceChange_Final.xlsx."

Notes:

A: Applies to systems that are conducting reduced lead tap monitoring less frequently than every 6 months. The estimates are based on input received from North Carolina and Indiana in response to a 2016 ASDWA questionnaire regarding potential 2021 LCRR requirements. A copy of the questionnaire and each State's responses are available in the docket under EPA-HQ-OW-2022-0801 at www.regulations.gov. North Carolina estimated 2 hours to review a change in source from ground water to another ground water source and 3 hours for surface water source changes or surface water/ground water mixing. Indiana estimated 6 hours to review a change to a similar source and 20 hours to review a change to a dissimilar source. The EPA used the average of the two State estimates of 2 and 6 hours (4 hours), doubled to 8 hours for systems, for the minimum and most likely value. The EPA set the most likely equal to the minimum because fewer than 1 percent of systems made more significant sources changes during 2013 - 2016. For the maximum, the EPA assumed the 20 hours were more reflective of the system burden to prepare needed documentation. To each estimate, the EPA assumed an additional 2 hours for consultation with the State on needed action in response to the source change.

B: Applies to systems conducting standard lead tap monitoring every six months under the final LCRI. Because these systems are in more frequent contact with the State, the EPA assumed 50 percent of the burden estimated to prepare and submit the documentation for *hrs_coop_source_chng_red_op* or 50 percent of 8 hours for the minimum and most likely and 50 percent of 20 hours for the maximum plus an additional 2 hours for consultation. This equals a total burden of 6 hours for the minimum and most likely and 12 hours for the maximum.

o) Notify and consult with the State on required actions in response to treatment change (hrs_coop_treat_chng_op). Systems are required to seek prior approval before making any long-term treatment changes to ensure that corrosion control is maintained. The estimated likelihood of a system changing treatment in a given year of 4.2 percent for all CWSs and 3.2 percent for all NTNCWSs (*p_treat_change*) is discussed in Chapter 3, Section 3.3.9.3 with percentages for CWSs and NTNCWSs presented in Exhibit 3-55 and Exhibit 3-56, respectively. Exhibit 4-70 below provides the burden for systems to report the change and consult with the State. Note that for the proposed LCRI EA (USEPA, 2023c), the EPA assumed a different burden for systems on standard and reduced monitoring. For the final rule, the EPA increased the burden estimates based on the ASDWA 2024 CoSTS model (ASDWA, 2024) and assumed systems and States would incur the same burden to report the change conduct a review, regardless of the system's monitoring schedule.

Exhibit 4-70: Estimated Hours per System to Report and Consult on Treatment Change

System Size (Population Served)	Hours for systems to report a treatment change and consult with the State *(hrs_coop_treat_chng_ op)*
≤100	46
101-500	46
501-1,000	46
1,001-3,300	46
3,301-50,000	84
>50,000	82

Source: "Likelihood_TreatmentChange_Final.xlsx;"; ASDWA, 2024.

Note: The estimates are based on ASDWA's 2024 CoSTS (ASDWA, 2024).

Exhibit 4-71 details how the data variables are used to estimate routine system activities related to CCT.

Exhibit 4-71: PWS Lead CCT Routine Cost Estimation in SafeWater LCR by Activity[1]

<table>
<tr><th rowspan="2">CWS Cost Per Activity</th><th rowspan="2">NTNCWS Cost Per Activity</th><th colspan="3">Conditions for Cost to Apply to a Model PWS</th></tr>
<tr><th>Lead 90^{th} - Range</th><th>Other Conditions</th><th>Frequency of Activity</th></tr>
<tr><td colspan="5">l) Review CCT guidance</td></tr>
<tr><td>Hours per system multiplied by the system labor rate.

(hrs_rev_cct_op * rate_op)</td><td>Cost applies as written to NTNCWSs.</td><td>All</td><td>Model PWSs with CCT serving >50,000 people</td><td>Once per Sanitary Survey[2]</td></tr>
<tr><td colspan="5">m) Provide WQP data to the State and discuss during sanitary survey[2]</td></tr>
<tr><td>Hours per system multiplied by the system labor rate.

(hrs_sanit_surv_op * rate_op)</td><td>Cost applies as written to NTNCWSs.</td><td>All</td><td>Model PWSs with CCT</td><td>Once per Sanitary Survey[2]</td></tr>
<tr><td colspan="5">n) Notify and consult with the State on response to a change in source water</td></tr>
<tr><td rowspan="2">The total hours per system multiplied by the system labor rate.

(hrs_coop_source_chng_rout_op* rate_op)</td><td rowspan="2">Cost applies as written to NTNCWSs.</td><td>At or below AL</td><td>Model PWS that is not on reduced tap sampling with a change in source water

1 - (p_tap_annual + p_tap_triennial + p_tap_nine) * p_source_chng</td><td rowspan="2">Once per event</td></tr>
<tr><td>Above AL</td><td>Model PWSs with a change in source water p_source_chng</td></tr>
</table>

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		
		Lead 90th - Range	Other Conditions	Frequency of Activity
The total hours per system multiplied by the system labor rate. *(hrs_coop_source_chng_red_op*rate_op)*		At or below AL	Model PWS that is on reduced tap sampling with a change in source water *(p_tap_annual + p_tap_triennial + p_tap_nine) * p_source_chng*	
o) Notify and consult with the State on response to a change in water treatment				
The total hours per system multiplied by the system labor rate. *(hrs_coop_treat_chng_op*rate_op)*	Cost applies as written to NTNCWSs.	All systems	Model PWS with a change in treatment *p_treat_change*	Once per Event

Acronyms: CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_tap_annual, p_tap_triennial,* and *p_tap_nine*: Likelihood a system will qualify to collect the reduced number of lead tap samples at an annual, triennial, and nine-year frequency, respectively (Chapter 3, Section 3.3.7.3).
- *p_source_chng*: Likelihood that a system will change sources in a given year (Chapter 3, Section 3.3.9.1).
- *p_treat_change:* Likelihood that a system will change treatment in a given year (Chapter 3, Section 3.3.9.3).
- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

4.3.3.5 Estimate of PWS National Corrosion Control Treatment Costs

Exhibit 4-72 shows the estimated national costs of CCT under the low and high cost scenarios, for the 2021 LCRR, the final LCRI, and the incremental cost, discounted at 2 percent. The monetized incremental annual CCT costs range from $39.1 million to $45.1 million in 2022 dollars. The CCT Operation and Maintenance (Existing) category in these exhibits are the EPA's estimate of the ongoing cost of operating corrosion control at PWSs where CCT was in place at the beginning of the period of analysis.[119]

[119] For additional context the average CCT cost per household for large systems (serving 10,000 or more people) is $10.56 per year.

Exhibit 4-72: Estimated National Annualized Corrosion Control Costs - 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
CCT Operations and Maintenance (Existing)	$458.2	$458.2	$0.0	$458.1	$458.1	$0.0
CCT Related Sanitary Survey and Source or Treatment Change Notification Activities	$2.5	$5.1	$2.6	$2.5	$5.1	$2.6
CCT Installation	$19.6	$45.1	$25.5	$50.1	$83.8	$33.7
CCT Installation Ancillary Activities	$6.2	$4.2	-$2.0	$10.9	$6.4	-$4.5
CCT Re-Optimization	$39.2	$32.6	-$6.6	$82.7	$71.7	-$11.0
CCT Re-Optimization Ancillary Activities	$5.9	$7.6	$1.7	$14.6	$13.5	-$1.1
Distribution System and Site Assessment (DSSA)	$4.8	$15.0	$10.2	$10.6	$27.2	$16.6
Ancillary DSSA Activities	$15.6	$23.3	$7.7	$18.3	$27.1	$8.8
Total Annual Corrosion Control Technology Costs	**$552.0**	**$591.1**	**$39.1**	**$647.8**	**$692.9**	**$45.1**

Acronyms: CCT = corrosion control treatment; LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

4.3.4 PWS Service Line Inventory and Replacement Costs

This section provides burden and cost estimates for inventory related activities and SLR-related activities under the final LCRI as follows:

- Section 4.3.4.1: Service Line Inventory, provides inputs related to classifying connector material in the updated LCRR initial inventory, preparing and submitting annual inventory updates, and inventory validation.
- Section 4.3.4.2: Service Line Replacement Plan, provides inputs related to the development of a service line replacement plan.
- Section 4.3.4.3: Physical Lead Service Line Replacement, provides inputs for replacements of LSLs and GRR service lines.
- Section 4.3.4.4: Ancillary Lead Service Line Replacement Activities, includes inputs for activities that are not related to the service line inventory nor physical replacements.

National annualized inventory and LSLR-related costs are presented at a 2 percent discount rate in Section 4.3.4.5.

4.3.4.1 Service Line Inventory

The discussion of service line inventory costs for water systems is presented in three subsections as follows:

- 4.3.4.1.1: Updating the LCRR Initial Inventory to Include Connector Materials
- 4.3.4.1.2: Inventory Updates
- 4.3.4.1.3: Inventory Validation

Exhibit 4-83 at the end of Section 4.3.4.1 is a summary exhibit that indicates how the cost inputs are modeled by the SafeWater LCR model. Note that the 2021 LCRR required systems to prepare an initial inventory by October 16, 2024, which is prior to the EA's period of analysis. Therefore, the cost for preparing the LCRR initial inventory, that does not include connector material information, is not included in the final LCRI analysis in this section nor the pre-2021 LCR baseline cost analysis in Appendix B. The LCRR initial inventory costs are outside of the period-of-analysis for the EA.

4.3.4.1.1 Updating the LCRR Initial Inventory to Include Connector Materials

The EPA has developed system costs for activities associated with the review of records for connector materials as shown in Exhibit 4-73. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-73: PWS Service Line Inventory Connector Review Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
a) Conduct records review for connector materials	0.5 to 7,599 hours per CWS per year	*hrs_updated_initial_inv_op*
b) Compile and submit connector updated LCRR initial inventory (baseline inventory[1]) to the State	1 to 4 hrs /CWSs; 3.75 to 15 hrs/NTNCWS	*hrs_report_updated_initial_inv_op*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Sources: Data sources for each activity are provided following this exhibit.
Note:
[1] Section 141.84(a)(2) of the final LCRI states: "All water systems must develop an updated initial inventory, known as the "baseline inventory."

Under the final LCRI, all water systems must update the LCRR initial inventory with information on connectors and submit it to the State three years after the publication of the final rule (or Year 3 of the rule analysis period). To develop the connector updated initial inventory (referred to in the final LCRI as the "baseline inventory"[120]), water systems must review any information listed below that describes connector material and location:

- All construction and plumbing codes, permits, and records or other documentation that indicate the service line and connector materials used to connect structures to the distribution system.
- All water system records on service lines and connectors, including distribution system maps and drawings, recent or historical records on each service connection and connector, meter installation records, historical capital improvement or master plans, and standard operating procedures.
- All records of inspections in the distribution system that indicate the material composition of the service connections and connectors that connect a structure to the distribution system.

Water systems must include each connector in their service line inventory and categorize it as lead, non-lead, unknown, or no connector present. If systems have already reviewed applicable records and categorized each connector in their inventory by material type and location, they are not required to re-review records.

Key assumptions for estimating the burden and cost for systems to conduct this records review and prepare and submit the updated LCRR initial inventory under the final LCRI are as follows:

- All CWSs, regardless of the extent of lead content service lines[121] and unknowns, will incur burden to review records for connector material and submit the updated LCRR initial inventory.

[120] Note § 141.84(a)(2) of the final LCRI states: "All water systems must develop an updated initial inventory, known as the "baseline inventory." Systems must submit the baseline inventory to the State by the compliance date in § 141.80(a)(3)." The EPA is using the term "updated LCRR initial inventory" in place of "baseline inventory" in the EA given the potential for confusion with the economic analysis concept of the baseline.
[121] As described in Chapter 3, Section 3.3.4.1, the EPA defines "lead content service lines" as those with lead lines, GRR, lead connectors, and galvanized previously downstream of lead connectors.

CWSs will *not* incur additional burden to make the inventory publicly accessible since this was required under the 2021 LCRR.

- The burden to review records for connector material is similar to the burden to review records for the initial inventory because the records required to be reviewed are similar. However, the EPA assumes that the review for connector material will be less burdensome due to several factors that will be described in this section.

- NTNCWSs will already have documentation of connector material because they own their own service lines, but will require time to gather the information and prepare a package for the State.

The EPA developed unit burden estimates separately for records review (activity a) for CWSs only) and reporting (activity b) for CWSs and NTNCWSs) as described below. Note that all calculations and assumptions are documented in the derivation file, "LCRI Updated Initial Inventory with Connectors_Final.xlsx" available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

a) Conduct records review for connector materials (hrs_updated_initial_inv_op)

As noted previously, the EPA assumed that the unit burden for records review under the final LCRI is similar to the burden for records review under the 2021 LCRR. Therefore, the EPA used an estimate of the burden for the 2021 LCRR records review as a starting value for the burden associated with conducting the LCRI required connector material records review. In the *Economic Analysis for the Final Lead and Copper Rule Revisions* (hereafter referred to as the "Final 2021 LCRR EA") (USEPA, 2020), the EPA estimated the burden for CWSs to conduct their records review based on limited information from water systems and States but since that time, new information has become available from the following key data sources:

- CDM Smith. 2022. *Considerations when Costing Lead Service Line Identification and Replacement.* American Water Works Association. This report includes responses from a survey of AWWA members regarding costs for developing a service line inventory. A total of 34 systems responded to the survey, representing 23 States and a wide range of system sizes.

- Liggett J. et al. 2022. *Service Line Material Identification: The Experiences from North American Water Systems.* American Water Works Association. This study provides results from 11 case studies of systems that have already completed their service line inventory.

- Responses to the EPA questions regarding the time needed to develop and maintain the LCR Service Line Inventory (USEPA, 2023e). This questionnaire was sent to nine systems in early 2023; EPA received responses from Grand Rapids, MI; Pittsburgh, PA; and Cincinnati, OH.

As the first step in this analysis, the EPA used these data sources to develop a revised unit burden (hours/CWS) for records review under the 2021 LCRR as follows:

- The EPA compiled system-level estimates of cost or burden for reviewing records (hours or $/SL) in the worksheet "Records Rev per SL Cost Input" in the derivation file "LCRI Updated Initial Inventory with Connectors_Final.xlsx." The EPA included findings from the CDM Smith Report (CDM Smith, 2022) for systems reporting new and previous records review efforts to represent the range of real-world scenarios. Where the data were reported as burden (hours), the EPA

used estimated labor rates in Chapter 3, Section 3.3.11.1 to convert all data to cost per service line reviewed.

- The EPA reviewed data sources and removed values that included additional activities beyond records review, such as field investigation.

- The EPA analyzed the data set for outliers[122] and removed them from the analysis.

The result was 17 individual estimates ranging from \$0.01 to \$16.22 per service line reviewed, with an average labor cost of **\$3.76 per service line** for the 2021 LCRR records review. The EPA used this value for all system sizes. This cost represents a range of 4 to 7 minutes per record using the PWS labor rates in Section 3.3.11.1.

Secondly, the EPA estimated the percentage of 2021 LCRR records review cost that will be incurred to review records for connector material under the final LCRI. The EPA assumed that systems would spend an average of **75%** of the 2021 LCRR burden to review records again for the LCRI (\$3.76/SL x 0.75 = **\$2.82/SL**) to account for the following factors:

- Systems will have already identified key sources of information including plumbing codes and construction standards under the 2021 LCRR.

- Some systems will have digitized paper records under the 2021 LCRR allowing faster records reviews for connector information under the final LCRI.

- Systems are not required to review previous material evaluations under the LCRI as they were under the 2021 LCRR.

- The EPA service line inventory guidance (USEPA, 2022b) recommends that systems track connector materials, thus some system may have already reviewed records for connectors when preparing their inventory under the 2021 LCRR.

As the third step, the EPA evaluated which service lines would be exempt from the records review for connector material. The EPA identified two scenarios under which systems could classify connector materials without a records review: (1) where service lines were installed after the lead ban, and (2) where the service lines are known to be lead and/or have lead connectors. The EPA's approach to accounting for these scenarios is described as follows:

- Systems can use the date of their local lead ban to identify buildings constructed after the lead ban and assume those service line connectors to be non-lead. The EPA reviewed housing stock data from the 2020 American Community Survey (U.S. Census Bureau, 2021) to estimate the percent of 1-unit detached or attached buildings built in 1990 or later, recognizing that this is conservative because local lead bans may have occurred earlier[123]. The EPA found that a total of

[122] Values were determined to be outliers if they fell outside the upper and lower bounds determined by quartile 1 minus 1.5 time the interquartile range, and quartile 3 plus 1.5 times the interquartile range (Verardi and Vermandele, 2018).

[123] The 1986 Safe Drinking Water Act (SDWA) Amendments prohibited the use of pipe, solder, and flux that were not "lead free" as defined in 1986 in new installations and repairs and directed states, as a condition of receiving grants for the Public Water System Supervision (PWSS) program, to enforce the provision effective 24 months after

33% of housing in the United States was constructed 1990 or later (see the worksheet "2020Physical Housing Char" in the derivation file "LCRI Updated Initial Inventory with Connectors_Final.xlsx" for the data and calculations).

- For the second scenario, the EPA assumed that systems would classify the connector as lead for service lines that are lead. Moreover, service lines that are reported as having a lead connector in the 7th DWINSA[124] would not require a records review because systems would already know the connector material. The EPA identified the percent of service connections that are LSLs (partial or full) and the percent that are lead connectors using the data presented in Section 3.3.4 of Chapter 3.

As the last step, the EPA used connection information from SDWIS/Fed, and PWS labor rates from Chapter 3, Section 3.3.11.1, and the assumptions above to calculate an **average unit burden per CWS** for records review for connector materials under the final LCRI. Exhibit 4-74 provides the calculations and results of this analysis. Note that the final unit burden for records review in Column J (SafeWater LCR model input *hrs_updated_initial_inv_op*) has been converted to an annual cost by taking the total estimated burden in Column I and dividing it by 3 assuming that the burden is spread equally over the first three years of the rule analysis period.

For NTNCWSs, the EPA assumes that they will not incur burden for this activity because they own their own service lines and thus will already have documentation of connector material. However, the EPA estimates that they will incur burden to compile the information, which is included with the reporting costs in activity b).

June 19, 1986, through state or local plumbing codes or other means (42 U.S. Code §300g-6(b)). Some states adopted their own laws before the federal requirement. Appendix D of the EPA Service Line Inventory Guidance (USEPA, 2022b) contains a summary of lead ban provisions by state. Nearly all of the states enacted the lead ban by 1989, so the EPA searched for 1-unit detached or attached buildings built in 1990 or later.

[124] Note that between the proposed and final LCRI EA, the EPA updated the service line material characterization based on the results of the one-time update to the 7th DWINSA. For more information, see Sections 3.2.5 and 3.3.4. For the purposes of this EA, the term "7th DWINSA" includes results from the original survey and the one-time update.

Exhibit 4-74: Estimated Unit Burden for CWSs to Review Records for Connector Material

System Size (Population Served)	System Labor Rate ($/hr)	Records Review for Connector Material (Burden / CWS)								
		Average Number of Service Lines (SLs) /CWS	Percent of SLs that Were Installed in 1990 or later	Percent of SLs that are Known LSLs or Lead Connectors	Average Number of SL Records/CWS that Need to be Reviewed for Connector Material	$ / SL for Records Review for the Initial Inventory	$ / SL for Records Review for Connector Material	Total $ / CWS ($2020) to Review Records for Connector Material	Estimated Total Hrs/ CWS to Conduct Records review for Connector Material	Estimated Annual Burden (hrs/CWS/yr) to Conduct Records Review for Connector Material (*hrs_updated initial_inv_op*)
	A	B	C	D	E = B*(1-C-D)	F	G = F*0.75	H = E*G	I = H/A	**J = I/3**
≤100	$33.39	27	33.0%	0.29%	18	$3.76	$2.82	$51	2	**0.5**
101-500	$33.39	107	33.0%	0.29%	71	$3.76	$2.82	$200	6	**2**
501-1,000	$33.39	304	33.0%	0.29%	202	$3.76	$2.82	$571	17	**6**
1,001-3,300	$33.39	759	33.0%	0.29%	506	$3.76	$2.82	$1,427	43	**14**
3,301-10,000	$39.81	2,225	33.0%	4.08%	1,400	$3.76	$2.82	$3,948	99	**33**
10,001-50,000	$42.68	7,880	33.0%	4.51%	4,923	$3.76	$2.82	$13,887	325	**108**
50,001-100,000	$46.11	23,344	33.0%	4.89%	14,495	$3.76	$2.82	$40,891	887	**296**
100,001-1,000,000	$52.42	78,750	33.0%	3.52%	49,978	$3.76	$2.82	$140,990	2,690	**897**
>1,000,000	$52.42	670,176	33.0%	3.78%	423,602	$3.76	$2.82	$1,194,997	22,797	**7,599**

Acronyms: CWS = community water system; LSL = lead service line; SL = service line.

Notes:

General: Applies to all CWSs assuming none have done a review of records for connector materials that includes all of the material classification categories under the LCRI (not required by any States). Assume that the estimated annual records review burden occurs each year in 2025, 2026, and 2027.

A. PWS Labor Rates as presented in Chapter 3, Section 3.3.11.1.

B. Chapter 3, Exhibit 3-14. Based on connection data from SDWIS 4th quarter 2020 frozen dataset, current through December 31, 2020. Adjusted for systems serving ≤ 100 people if the reported population was less than 25 or if the number of people per connection was less than 1 or greater than five.

C. Derivation file "LCRI Updated Initial Inventory with Connectors_Final.xlsx", worksheet "2020Physical Housing Character." Based on the percent of single family detached and attached homes in the U.S. that were built in 1990 or after, which is after the lead ban took effect (U.S. Census Bureau, 2021). Assumes that all connectors installed after the lead ban took effect would be classified as "Never Lead."

D. Percent of systems with lead content (*p_lsl*) times percent of service lines in those systems that are unknown (*perc_lsl_known*) times the percent of service lines that are known lead *(perc_lsl_known_lead*) times the sum of the percent of known LSLs that are full or partial LSLs and lead connectors (*pp_lsl_full* + *pp_lsl_partial* + *pp_lsl_connector*). See Chapter 3, Exhibits 3-10, 3-15, and 3-19 for these values. The EPA assumes that systems will be able to assign these connectors as "lead" without needing to review records again.

F. Based on analysis of system-level burden and cost estimates per service line reviewed. See the derivation file "LCRI Updated Initial Inventory with Connectors_Final.xlsx", worksheets "Records Rev per SL Cost Input" and "Records Rev Data Analysis."

b) Compile and submit connector updated LCRR initial inventory (baseline inventory) to the State (hrs_report_updated_initial_inv_op)

The EPA assumed that in addition to the records review, CWSs will incur additional burden to compile connector material information and submit an updated LCRR initial inventory to their State. The EPA based this burden estimate on the burden to compile and submit the service line inventory under the 2021 LCRR, which was 10 to 40 hours depending on system size (USEPA, 2020). The EPA assumed this burden for the final LCRI to be much smaller than the burden for compiling and submitting the LCRR initial inventory because the inventory structure is already in place. The EPA assumed that systems will add one column to their LCRR initial inventory to capture connector material information and resubmit it. The EPA assumed that this effort to capture connector information and resubmit it will take approximately 10 percent of the effort to compile and submit the 2021 LCRR initial inventory. See Exhibit 4-75 for the estimated burden.

For NTNCWSs, the EPA assumes that they will already have documentation of connector material because they own their own service lines, but will require time to gather the information and prepare a package for the State. Consistent with assumptions for CWSs, the EPA used the burden estimate for compiling and submitting the 2021 LCRR initial inventory, which was 5 to 20 hours per NTNCWS depending on system size, as a starting point (USEPA, 2021). The EPA used a higher percentage for NTNCWSs compared to CWSs because NTNCWSs need to compile information in addition to reporting. The EPA assumed that NTNCWSs will incur 75 percent of the burden used for the 2021 LCRR inventory to compile and submit an updated LCRR initial inventory with connector material under the final LCRI. See Exhibit 4-75 for the estimated burden.

Exhibit 4-75: Estimated Unit Burden for CWSs and NTNCWSs to Compile and Submit the Connector Updated LCRR Initial Inventory

System Size (Population Served)	Hours per system to compile and submit connector updated LCRR initial inventory ***SafeWater LCR input*** *(hrs_report_updated_initial_inv_op)*	
	CWS	NTNCWS
	A	B
≤100	1	3.75
101-500	1	3.75
501-1,000	1	3.75
1,001-3,300	1	3.75
3,301-10,000	2	7.5
10,001-50,000	2	7.5
50,001-100,000	4	15
100,001-1,000,000	4	15
>1,000,000	4	N/A

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Note: Applies to all CWSs and NTNCWSs. The EPA assumes these burdens are incurred in Year 3 of the rule analysis period.
Sources:

A: The EPA assumed that in addition to the records review, CWSs will incur additional burden to compile connector material information and submit an updated LCRR initial inventory) to their State. The EPA assumed this burden to be much smaller than the burden for compiling and submitting the LCRR initial inventory because the inventory structure is already in place. The EPA assumed that this effort will take approximately 10 percent of the effort to compile and submit the 2021 LCRR initial inventory. See the derivation file "LCRI Updated Initial Inventory with Connectors_Final.xlsx," worksheet "CWS Rep Updated Inv."
B: The EPA assumes that NTNCWSs will already have documentation of connector material because they own their own service lines, but will require time to gather the information and prepare a package for the State. The EPA assumes that preparing and submitting the connector updated LCRR initial inventory under the LCRI will take approximately 75 percent of the burden to prepare the 2021 LCRR initial inventory, not including the hours to prepare a tracking system for NTNCWSs with lead content service lines. See the derivation file "LCRI Updated Initial Inventory with Connectors_Final.xlsx", worksheet "NTNCWS Rep Updated Inv."

4.3.4.1.2 Inventory Updates

Under the 2021 LCRR, systems are required to update their initial inventory and submit annual updates to their State beginning October 16, 2025. Under the final LCRI, systems must continue making annual updates, tracking both changes in service lines and connector materials, starting the year after they submit their connector updated LCRR initial inventory. The connector updated LCRR initial inventory is expected to be due on October 16, 2027, so the first annual update under the final LCRI would be by October 16, 2028.

Under the 2021 LCRR and continued under the final LCRI, inventory updates must reflect replacements of lead or GRR service lines and service line material inspections. Under the final LCRI, inventory updates must also reflect lead connector replacements. Under both the 2021 LCRR and final LCRI, the inventory must also be updated with any other resource, information, or identification method allowed or required by the State to assess service line and connector materials. Moreover, water systems must identify service line and connector materials as they are encountered in the course of normal operations (*e.g.*, checking service line materials when reading water meters or performing maintenance activities) and use this information to update their inventory including the associated addresses.

Under the final LCRI, lead connectors must be replaced when encountered during planned or unplanned water system infrastructure work unless the connector is not under the control of the system. Because connectors are not required to be identified or replaced on a specific schedule under the final LCRI, the EPA assumes that they will most often be identified and replaced in tandem with service line inspections and replacement. The EPA assumes that the incremental burden for updating the connector material while updating the service line material in the inventory would be minimal. Thus, the EPA assumes that the system burden and costs associated with inventory updates are similar under the final LCRI and the 2021 LCRR and presents a single unit cost in this section for updating the service line inventory.

The activities associated with the update of the service line inventory are shown in Exhibit 4-76. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-76: PWS Service Line Inventory Update Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
c) Identify material for unknown service lines	$35.94 to $52.55 per unknown service line investigated	*cost_update*
d) Report annual inventory updates to the State	1 hr per CWS or NTNCWS per year for systems with lead content and/or unknowns	*hrs_report_inv_op*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Sources: Data sources for each activity are provided following this exhibit.

Key assumptions for estimating the burden and cost for inventory updates are as follows:

- NTNCWSs will not incur burden or cost to update their inventory since they own their own service lines are not expected to have any unknowns. NTNCWSs with lead content service lines will incur burden, however, to submit annual inventory updates to reflect SLRs.
- Burden and costs to identify service lines material only apply to CWSs with unknown service lines. CWSs that did not report any unknowns (*e.g.*, systems with all non-lead or systems with a mix of lead and non-lead) are expected to have good data on their service line material and do not need to conduct investigations.
- CWSs will use a combination of two methods to determine the service line material of unknowns: (1) identify material during normal operation as required under the final LCRI, and (2) conduct field investigations.
- Field investigations will focus on the customer-owned portion of the service line.
- The EPA assumes that CWSs with unknowns will investigate them at an average rate of 10 percent per year starting in Year 1 of the period of analysis. This assumption is based on the requirement that all lead status unknown service lines be identified by the mandatory SLR deadline, which is 10 years unless the State has set a shorter schedule or approved a deferred rate under the final LCRI.

This section provides burden and cost estimates separately for (c) identifying service line material for unknowns for CWSs only and (d) reporting inventory updates for CWSs and NTNCWSs.

c) Identify material for unknown service lines (cost_update)

As noted previously, the EPA estimates that systems will use a combination of two methods to identify unknowns: (1) identify materials during normal operation, and (2) perform field investigations. These methods are described below, followed by the approach for combining the costs of the two methods to produce a weighted average cost per service line.

(1) Normal Operations

To estimate the unit burden for identifying service line material during normal operation, the EPA used information from the CDM Smith report (CDM Smith, 2022). In Section 3.3.3, CDM Smith noted that "The study team assumed that the additional time required above and beyond the time already devoted to the inspection would be an estimated 30 minutes of staff time to see the material, record the information, take photographs and then update the inventory per service line." The EPA used this estimate of 30 minutes, or 0.5 hours per service line for systems serving < 100,000 people. For systems serving ≥ 100,000 people, the EPA assumed CWSs would use an automated process to update the inventory such as the enhanced work order process developed by the Pittsburg Water and Sewer Authority (PWSA) to capture and upload service line material data during meter replacements (USEPA, 2023e). The EPA estimated that use of an automated process would require less burden at approximately 10 minutes, or 0.2 hours per service line.

To estimate the percent of unknows that could be identified during normal operations, the EPA evaluated the frequency of activities that could expose service line material. The 2022 inventory guidance manual (USEPA, 2022b) identifies the following opportunities for data collection under normal operations:

- Water meter reading
- Water meter repair or replacement
- Service line repair or replacement
- Water main repair or replacement
- Backflow prevention inspections
- Other street repair or capital projects with open cut excavation

To estimate the frequency of these events, the EPA made the following assumptions:

- Meters are replaced an average of 6 percent per year based on an average meter lifespan of approximately 15-20 years based on information from the city of Pasadena, Texas (Pasadena, no date).
- Water mains are replaced at a typical rate of 1 percent per year based on total installed length (Folkman, 2018), and that these replacements result in an opportunity to inspect a proportional percent of service connections.

The EPA made a conservative assumption that an additional 0.5 percent of service lines are exposed during water meter reading, service line repair or replacement, backflow prevention inspections, and other street repair or capital projects with open cut excavations. Thus, the total percent of service connections that could be inspected each year during normal operations is estimated at **7.5 percent.**

(*2) Field investigations*

To estimate the costs for field investigations, the EPA used a 3-step process as described below.

Step 1: Identify commonly used field investigation methods: The EPA reviewed information on the use of service line investigation methods as presented in the EPA service line inventory survey (USEPA, 2023e), the CDM Smith Report (CDM Smith, 2022), and Bukhari et al. 2020. The following methods were identified as the most common methods used by water systems:

- Visual inspection by customer inside the house
- Visual inspection by water system personnel inside the house
- Vacuum excavation
- Mechanical excavation

Closed circuit television (CCTV) inspection and water quality sampling were not used because of their potential limitations in definitively identifying non-lead service lines (USEPA, 2022b). Predictive modeling was not included due to questions regarding its availability to large numbers of systems.

Step 2: Compile cost data from the literature and calculate an average unit cost per investigation method. The EPA compiled cost estimates for each service line investigation method from the EPA service line inventory survey (USEPA, 2023e), the CDM Smith Report (CDM Smith, 2022), Bukhari et al., 2020; and Hensley et al., 2021. The EPA made adjustments to account for non-labor costs of a lead swab for visual inspection and providing a filter for excavation techniques as required by the final LCRI. The EPA also adjusted the cost for mechanical excavation to account for the scenario where the water system finds an LSL or GRR service line during excavation and replaces it at that time. The EPA estimates that this scenario will occur approximately half of the time based on information provided by the Pittsburgh Water and Sewer Authority for the EPA service line inventory survey (USEPA, 2023e). When systems find a lead or GRR service line during mechanical excavation, the EPA assumes that the system will replace it and the cost for excavation is incorporated into the SLR cost. As shown in Exhibit 4-77, the cost for individual investigation methods ranges from $40.50 to $777.11.

Exhibit 4-77: Average Cost per Service Line Investigated for Four Investigation Methods

Investigation Method	Range of $/SL Material Investigated from the Literature and Survey	Average $/SL Material Investigated from the Literature and Survey [1]	Additional Non-Labor Costs	Additional Non-Labor Costs Notes	Cost Adjustment	Cost Adjustment Notes	Average $/SL Investigated
Visual inspection by customer (mail campaign) inside the house	$8.44 - $115.88	$40.50					**$40.50**
Visual inspection by water system personnel inside the house	$17.29 - $103.79	$56.25	$4.50	Lead swabs [2]			**$60.75**
Vacuum Excavation	$210.80 - $450	$307.60	$64.21	Cost for filter and door hanger [3]			**$371.81**
Mechanical Excavation	$700 - $2,190	$1,490.00	$64.21	Cost for filter and door hanger [3]	50%	Reduced to 50% of average cost to account for LSLs being found and replaced [4]	**$777.11**

Acronyms: SL = service line.

Notes:

[1] Based on data presented in the CDM Smith Report (CDM Smith, 2022), Bukhari et al., 2020; Hensley et al., 2021; and the EPA service line inventory survey. For detailed estimates per system, see the derivation file "Inventory Updates and Validation_Final.xlsx", worksheet "Unit Costs per Field Method."

[2] The cost of a lead swab that could be used to test the pipe material was reported in CDM Smith 2022.

[3] Systems are required to provide filters under the final LCRI after disturbance due to inventorying, which the EPA assumed would occur during a vacuum or mechanical excavation. The EPA assumed that systems will provide a door hanger to alert customers of potential temporary elevated lead levels after the disturbance, as recommended in the EPA inventory guidance (USEPA, 2022b) and required under the LCRI (cost = $0.21/hanger, see derivation file "Public Education Inputs_CWS_Final.xlsx", worksheet "Service Line Disturbances." The cost to develop the public education materials is accounted for in this worksheet). The EPA assumed minimal burden (not included) for system personnel to deliver door hangers because they are already on or near the customer's

property. The cost of the filter is SafeWater variable *cost_filter_hh* and is estimated to be $64 (see *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b)).

[4] Adjustment to mechanical excavation cost to account for the assumption that systems are doing SLR if a lead or GRR service line is found. When lead or GRR service lines are found, the EPA assumes that systems would replace them and the investigation costs for mechanical excavation would be incorporated into the SLR cost. The EPA assumed LSLs and GRR service lines are found 50 percent based on information provided by the Pittsburgh Water and Sewer Authority for the EPA LCRR survey (USEPA, 2023e).

Step 3: Create a decision tree to develop a weighted average unit cost ($/SL) for all investigation methods. The EPA used information in Hensley et al. (2021) and case study examples in CDM Smith (2022) Tables 3-11, 3-12 to develop a least cost decision tree for systems serving ≤1,000, 1,001 - 10,000, and > 10,000 people. Results are shown in Exhibit 4-78 and assumptions are provided below the exhibit.

The EPA recognizes that there are areas of uncertainty in this approach. For example, this approach does not capture instances where more than one visual inspection method is needed to identify the material of the service line. On the other hand, the EPA did not include water quality sampling and predictive modeling, which may be used to screen large numbers of service lines at a lower cost compared to visual field inspection. The EPA also recognizes that systems may be able to identify all of their unknowns during normal operation and not do any field investigations.

Exhibit 4-78: Least-Cost Decision Tree and Weighted Average Cost for Field Investigations

System Size (Population Served)	Field Investigation Method Decision Tree[1]	Percent of Service Lines Identified by Each Investigation Type (sum to 100%)	$/SL Line Investigated Per Method	Weighted Average $/SL Line Investigated
≤ 1,000	Visual inspection by customer (mail campaign) inside the house	40	$40.50	**$160.10**
≤ 1,000	Visual inspection by water system personnel inside the house	45	$60.75	
≤ 1,000	Mechanical Excavation	15	$777.11	
1,001-10,000	Visual inspection by customer (mail campaign) inside the house	45	$40.50	**$138.82**
1,001-10,000	Visual inspection by water system personnel inside the house	40	$60.75	
1,001-10,000	Vacuum Excavation	5	$371.81	
1,001-10,000	Mechanical Excavation	10	$777.11	
>10,000	Visual inspection by customer (mail campaign) inside the house	50	$40.50	**$117.55**
>10,000	Visual inspection by water system personnel inside the house	35	$60.75	
>10,000	Vacuum Excavation	10	$371.81	
>10,000	Mechanical Excavation	5	$777.11	

Acronyms: SL = service line.

Notes:

[1] The decision tree assumes that systems will use the lower cost methods as much as possible then move to more expensive methods, consistent with the approach presented Hensley et al. (2021), Figure 6. Smaller systems will use more simple methods compared to larger systems. The EPA assumed that systems serving 1,000 or fewer people would not use vacuum excavation because it requires special equipment or a contractor, but that CWSs serving more than 1,000 people would use this method as a cheaper alternative to mechanical excavation.

As the final step for estimating the unit cost for identifying unknown service material, the EPA combined the results from method (1) normal operations and method (2) field investigations to produce an overall

weighted average unit cost to identify unknowns. As noted previously, the EPA estimated that 7.5 percent of unknown service lines can be identified each year during normal operations. Although not required under the final LCRI, the EPA anticipates that systems will also perform field investigations of unknowns to expedite SLR and meet the lead and GRR SLR schedule. The EPA estimates that systems will conduct field investigation of an additional 2.5 percent of unknowns each year, for a total of 10 percent of unknowns identified each year using both methods.

Exhibit 4-79 shows the weighted average unit costs for identifying unknowns service lines. The EPA assumed that systems will begin these updates in Year 1 of the analysis period. The EPA used the estimates of unknown service lines based on the 7th DWINSA as presented in Chapter 3, Section 3.3.4. The EPA recognizes that this estimate of unknowns is conservatively high because it represents 2021 data, prior to when systems were required to review records for their 2021 LCRR initial inventory.

Exhibit 4-79: Weighted Average Unit Cost ($/SL) for Identifying service line material of "Unknowns" for the Inventory Updates (CWSs only)

System Size (Population Served)	Unit Burden for Collecting Inventory Information during Normal Operations (hrs/SL)	Average Unit Cost for Conducting Field Investigation of SL Material ($/SL)	Weighted average unit cost ($/SL) for identifying unknowns for the inventory update (*cost_update*)
	A	B	C = (A*Labor rate*0.75)+(B*0.25)
≤100	0.5	$159.73	**$52.55**
101-500	0.5	$159.73	**$52.55**
501-1,000	0.5	$159.73	**$52.55**
1,001-3,300	0.5	$138.32	**$47.23**
3,301-10,000	0.5	$138.32	**$49.63**
10,001-50,000	0.5	$116.92	**$45.39**
50,001-100,000	0.5	$116.92	**$46.68**
100,001-1,000,000	0.2	$116.92	**$35.94**
>1,000,000	0.2	$116.92	**$35.94**

Acronyms: SL = service line.
Notes:
Applies to CWSs with unknown service lines and the number of unknowns in those systems as reported in the 7th DWINSA. The EPA assumes that systems investigate 10 percent of their unknowns to update their inventory each year starting in Year 1 of the analysis period.
Sources: "Inventory Updates and Validation_Final.xlsx," worksheet "CWS Inventory Update Est."
A: For systems serving ≤100,000 people, based on CDM Smith report. For systems serving > 100,000 people, the EPA assumed CWSs would use an automated process to update the inventory such as the enhanced work order process developed by the Pittsburg Water and Sewer Authority (PWSA) to capture and upload service line material data during meter replacements (USEPA, 2023e). The EPA estimated that use of an automated process would require less burden at approximately 10 minutes per service line (0.2 hours).
B: Exhibit 4-78.

C: Assume that 75 percent of unknowns are identified during normal operation and 25 percent are identified through field investigations of service line material. Labor burden for normal operations is converted to $2020 using the PWS labor rates in Section 3.3.11.1.

d) Report annual inventory updates to the State (hrs_report_inv_op)

The EPA assumed that CWSs and NTNCWSs will incur burden to submit annual inventory updates to their State. The EPA assumed this burden to be small because systems will be updating their inventory throughout the year as they investigate unknowns and replace lead and GRR service lines. The EPA estimated that CWSs and NTNCWSs would spend 1 hour per year submitting the updated inventory to their State via email (thus no no-labor costs). Note that this burden applies to systems with lead content and/or unknown service lines, not just systems with unknowns as with the previous section because systems with lead content and no unknowns would still need to submit inventory updates as they replace LSLs and GRR service lines. See Chapter 3, Section 3.3.4 for the estimates of systems with lead content and/or unknown service lines.

4.3.4.1.3 Inventory Validation

The EPA has developed system costs for activities associated with the validation of non-lead service lines as shown in Exhibit 4-80. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-80: PWS Inventory Validation Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	***SafeWater LCR Data Variable***
e) Conduct field investigations for inventory validation	$432.56 per non-lead service line validated	*cost_valid*
f) Report validation results to the State	1 hr per CWS or NTNCWS	*hrs_valid_report_op*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Sources: Data sources for each activity are provided following this exhibit.

All water systems must validate the accuracy of non-lead service line categorization in the inventory.[125]Water systems must identify a validation pool of non-lead service lines, excluding service lines identified as non-lead through (1) records indicating the service line was installed after the effective date of the Federal, State, or local lead ban, (2) a two-point visual inspection, or (3) previously replaced lead or GRR service lines.[126] Systems must select a random sample of non-lead service lines from the validation pool that meet the minimum requirements in Exhibit 4-81. Each service line must be validated

[125] The EPA is finalizing a flexibility for systems to be able to make a written request to the State to approve a waiver of the inventory validation requirements if the system has completed validation efforts that are at least as stringent as the LCRI requirements. This EA may be overestimating validation costs to the degree that States waive the requirement.

[126] In the proposed LCRI, all non-lead service lines identified through records review were excluded from the validation pool. For the proposed LCRI EA, the validation pool consisted of only the unknowns found to be non-lead. In addition, the EPA assumed NTNCWSs would have no service lines of unknown materials and thus did not include them in the proposed LCRI EA.

by a minimum of two-point visual inspection. Where ownership is shared, the water system must conduct at least one visual inspection on each portion of the service line. Where ownership is shared and only one portion of the service line is included in the validation pool, systems need to conduct at least one point of visual inspection on the unconfirmed portion of the service line.

Exhibit 4-81: Minimum Non-lead Service Line Validation Requirements of the Final LCRI

Size of Validation Pool	Number of Validations Required (per system)
Fewer than 1,500	20% of validation pool
1,500-2,000	322
2,001-3,000	341
3,001-4,000	351
4,001-6,000	361
6,001-10,000	371
10,001-50,000	381
>50,000	384

The EPA estimated the number of validations required and the unit cost per validation (in dollars per service line or $/SL). Key assumptions are below:

- Burden and cost for validation apply to all systems.
- Systems will conduct validation in Year 8 of the period of analysis.
- The validation pool consists of two kinds of non-lead service lines:
    - Part 1: Unknown service lines reported in the 7th DWINSA that are found to be non-lead through inventory updates, except those determined to be non-lead though a two-point visual inspection.
    - Part 2: Non-lead services lines reported in the 7th DWINSA that were installed before the Federal, State, or local lead ban and are not previously replaced LSL or GRR service lines.
- All validations will be done using field investigations at two points along the service lines.

The following sections show the unit cost ($/SL) for conducting field investigations for validation (activity e)) and the burden (hours/CWS) for reporting validation results (activity f)).

e) Conduct field investigations for inventory validation (cost_valid)

To estimate the cost of validation, the EPA used a two-step process: Step 1, determine the size of the validation pool and the corresponding number of validations required per system and Step 2, estimate the unit cost ($/SL) per validation.

Step 1: Determine the size of the validation pool and the corresponding number of validations required per system. The EPA estimates the number of non-lead service lines in the validation pool to be the sum of two parts as described below. The EPA then uses the total non-lead service lines in the validation pool to determine the minimum number of validations required as shown in Exhibit 4-81. **Part 1 of the validation pool: Unknown Service Lines that are found to be non-lead (applies to CWSs only):** As previously stated, the EPA assumed NTNCWSs will have no unknown service lines. Thus, the EPA used the following assumptions to estimate this portion of the validation pool for CWSs only:

- Systems will investigate an average of 10 percent of their unknowns each year as part of inventory updates starting at Year 1 of the LCRI rule period of analysis. See Section 4.3.4.1.2 for the rationale for this assumption.
- Validation will occur in Year 8 of the period of analysis. The percent of all unknowns that are investigated by the time the system begins validation is 10 percent x 7 years = 70 percent.
- The proportion of unknowns investigated that are found to be non-lead is one minus the estimated proportion of unknowns found to be lead as presented in Section 3.3.4, Column E of Exhibit 3-11.
- Unknowns that were inspected using vacuum or mechanical excavation would be inspected at two or more locations and thus, would be excluded from the validation pool.[127] Based on the estimated mix of field inspection methods shown in Exhibit 4-78, the EPA calculated that ***15 percent*** of unknowns were inspected using vacuum or mechanical excavation and would be excluded from the validation pool.
- In summary, for each CWS in the SafeWater LCR model, Part 1 of the validation pool is equal to:
    - The number of unknown service lines from the 7th DWINSA, multiplied by
    - The percent of all unknown service lines that are investigated (70 percent), multiplied by
    - The percent of unknowns that are found to be non-lead (1 - *perc_unknown_lead*, as presented in Section 3.3.4, Exhibit 3-15, Column E), multiplied by
    - The percent of unknowns that were investigated by methods other than vacuum or mechanical excavation (85 percent).

Part 2 of the validation pool: Non-lead service lines installed before the lead ban (CWSs and NTNCWSs):

For each CWS, the EPA used the following assumptions to estimate this part of the validation pool:

- Thirty-three percent of service lines were installed as new construction after the Federal lead ban (assumed to be 1990) based on a review of housing stock data. (For additional details and

[127] For the proposed LCRI, the EPA estimated that all unknowns found to be non-lead would be identified as non-lead by visual identification at one point during normal operation or field inspection. Under the final LCRI, the EPA is assuming that unknowns that were inspected using vacuum or mechanical excavation would be inspected at two or more locations and thus, would be excluded from the validation pool. The EPA conservatively assumes that remaining unknowns found to be lead would still need two points of visual inspection for validation.

references for this assumption, see Section 4.3.4.1.1, Exhibit 4-74, Column C.) These service lines are excluded from the validation pool based on the rule requirements. The remaining 67 percent of non-lead service lines are assumed to be installed before the lead ban and are included in the validation pool.

- CWSs have been replacing LSLs at a rate of 1 percent per year as part of normal infrastructure programs between 1991 and 2020, and approximately 28 percent of those would be full replacements. (For additional details and references for this assumption, see Section 3.3.4.1.2, Step 7). Thus, the EPA assumed that of the remaining non-lead service lines that could be in the validation pool, approximately 8 percent (1%/year x 29 years x 28% = 8%) would be replaced LSLs and excluded from the validation pool. The remaining 92 percent are assumed to be something other than replaced LSLs and would be included in the validation pool.
- In summary, for each CWS in the SafeWater LCR model, Part 2 of the validation pool is equal to:
  - The number of non-lead service lines per CWS from the 7th DWINSA, multiplied by
  - The percent of service lines installed before the Federal Lead Ban (67 percent), multiplied by
  - The percent of service lines that are not previously replaced LSLs or GRR (92 percent).

For each CWS, the EPA added the results of Parts 1 and 2 to determine the total size of the validation pool. Based on this total, the EPA determined the required number of non-lead service lines that must be validated using the final LCRI requirements shown in Exhibit 4-81.

For each NTNCWS the EPA used the following assumptions to estimate this part of the validation pool:

- An estimated 97.5 percent of NTNCWSs have all non-lead service lines as presented in Chapter 3, Section 3.3.4.2.1.
- For the estimated 2.5 percent of NTNCWSs that have lead content service lines, assume that *all* service lines in are lead content. This is consistent with the estimates presented in Chapter 3, Exhibit 3-23 with one exception: For NTNCWSs serving 10,000 to 50,000 people, the EPA estimates that between 50 and 100 percent of service lines in those systems are lead content. The EPA made a simplifying assumption that this value is 100 percent for the validation analysis to simplify the SafeWater LCR modeling process and recognizing that uncertainty in this assumption would have a very small/de minimums impact on total validation costs.
- Use the first reported date in SDWIS/Fed to identify the proportion of NTNCWSs installed after the lead ban. The EPA recognizes uncertainty in this assumption in that the first reported date could be before or after service line installation; however, the first reported date is when the facility was considered a public water system, so it is logical to assume that this date closely approximates when the utility installed its water service lines. Using SDWIS/Fed 4th Quarter 2020 data, an estimated 9,326 NTNCWSs have a first reported date after 1990, which is 54 percent of the total number of NTNCWSs (9,326/17,418 total NTNCWSs = 54%). Thus, the estimated percentage of NTNCWSs installed before the lead ban and potentially in the validation pool is 1 – 0.54, or 46 percent.
- In summary, for each NTNCWS in the SafeWater LCR Model, the validation pool is equal to:

- The percent of NTNCWSs with non-lead service lines (97.5 percent), multiplied by:
- The percent of NTNCWSs installed before the lead ban (46 percent), multiplied by:
- The number of service lines per NTNCWS from SDWIS/Fed 4th quarter 2020.

The EPA conservatively assumed that none of the non-lead service lines in NTNCWSs are previously replaced LSLs. For each NTNCWS, the EPA used the results of Part 2 to determine the required number of non-lead service lines that must be validated using the final LCRI requirements shown in Exhibit 4-81.

Step 2: Estimate the unit cost per validation.

Validation must be done at a minimum of two points along the service line and must include the system-owned and customer-owned portions where ownership is split. Where ownership is shared and only one portion of the service line is included in the validation pool, systems need to conduct at least one point of visual inspection on the unconfirmed portion of the service line. The EPA made a conservative assumption that all validations would require two points of visual inspection to meet final LCRI requirements. This approach overestimates situations where validation is needed, for example, just on the customer-owned portion of the service line at one point.

The EPA estimated that the field investigation methods used for validation would be the combination of (1) vacuum excavation at one location along the service line, and (2) visual inspection by water system personnel at the second location inside the house. The EPA did not consider mechanical excavation due to its high cost compared to vacuum excavation and the fact that water systems have significant time to find vacuum inspection contractors or purchase equipment prior to the validation due date (*i.e.*, Year 10 of the analysis period). This assumption could result in an underestimate of unit costs when mechanical excavation is used. However, this approach would overestimate unit costs when vacuum excavation can be used for both points of a visual inspection, or when systems can use in-home inspection and a second inspection that does not involve excavation such as visual inspection in the meter pit or curb box.

The derivation of the unit cost for validations is shown in Exhibit 4-82. Note that the EPA assumed the same average unit cost for validation at CWSs and NTNCWSs regardless of system size.

Exhibit 4-82: Unit Cost ($/SL) for Validation

Unit Cost for Vacuum Excavation	Unit Cost for Visual Inspection by Water System Personnel Inside the House	Total Unit Cost per Validation (*cost_valid*)
A	B	C=A+B
$371.81	$60.75	**$432.56**

Sources: Derivation file “Inventory Updates and Validation_final.xlsx,” worksheet “Unit Cost for Valid.”
Notes: Applies to all CWSs and NTNCWSs regardless of system size.
A: Exhibit 4-77, row 3, includes cost for filter and door hanger.
B: Exhibit 4-77, row 2, include cost for lead swab that could be used to test the pipe material.

f) Report validation results to the State (hrs_report_valid_op)

The EPA assumes that CWSs and NTNCWSs will summarize the results of validation (*e.g.*, how many service lines were confirmed non-lead or if any were found to be lead or GRR service lines) in email communications and that this will take approximately 1 hour.

Exhibit 4-83 provides the SafeWater LCR model costing approach for these inventory-related activities including additional cost inputs that are required to calculate the total costs.

Exhibit 4-83: Lead Service Line Inventory Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
a) Conduct records review of connector materials				
The total hours per system multiplied by the system labor rate. *hrs_updated_initial_inv_op*rate_op*	Cost applies as written to NTNCWSs.	All	All Model PWS	Once a year for first three years
b) Compile and submit connector updated LCRR initial inventory (baseline inventory) to the State				
The total hours per system multiplied by the system labor rate. *hrs_report_updated_initial_inv_op*rate_op*	Cost applies as written to NTNCWSs.	All	All Model PWS	Once a year for first three years
c) Identify material for unknown service lines				
The cost per service line multiplied by the number unknown lines identified. *num_unknown_resolved*cost_update*	Cost does not apply NTNCWSs.	All	All Model PWS with service lines of unknown content	Once a year for first 10 years
d) Report annual inventory updates to the State				
The total hours per system multiplied by the system labor rate. *hrs_report_inv_op*rate_op*	Cost applies as written to NTNCWSs.	All	All Model PWS with service lines of lead or unknown content	Once a year for first 10 years
e) Conduct field investigations for inventory validation				
The cost per service line multiplied by the number of lines validated. *num_lsl_validated*cost_valid*	Cost applies as written to NTNCWSs.	All	All Model PWS	Once
f) Report validation results to the State				
The total hours per system multiplied by the system labor rate. *hrs_valid_report_op*rate_op*	Cost applies as written to NTNCWSs.	All	All Model PWS	Once

Acronyms: CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PWS = public water system.
Notes:
[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] PWSs with lead content or unknown lines are identified using the data variables and approach described in Chapter 3, Section 3.3.4.

4.3.4.2 Service Line Replacement Plan

This section summarizes the EPA's cost estimate for the SLR plan that must be completed by all systems with lead, GRR, or service lines of unknown material at the start of the rule and updated annually thereafter. It also provides activities for periodic review and consultation with the State on the subset of systems that are seeking or have been approved for a deferred SLR. Exhibit 4-84 provides the unit burden and/or cost for these activities. The assumptions used in the estimation of the unit burden and cost follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-84: PWS SLR Plan Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
g) Develop initial SLR plan and submit to the State for review (one-time)	12 to 36 hrs/CWS; 12 hrs/NTNCWS	*hrs_slr_plan_op*
h) Identify funding options for full SLRs	68 to 170 hrs/CWS	*hrs_fin_op_op*
i) Include information on deferred deadline and associated replacement rate in the SLR plan (one-time)[1]	3 to 9 hrs/CWS seeking a deferral; 3 hrs/NTNCWS seeking a deferral	*hrs_slr_plan_defer_op*
j) Update SLR plan annually or certify no changes	2 to 4 hrs/CWS; 2 hrs/NTNCWS	*hrs_slr_plan_update_op*
k) Provide an updated recommendation of the deferred deadline and associated replacement rate[1]	3 to 9 hrs/CWS on a deferred SLR rate; 3 hrs/NTNCWS on a deferred SLR rate	*hrs_defer_update_op*

Acronyms: CWS = community water system; SLR = service line replacement; NTNCWS = non-transient non-community water system.
Sources: Data sources for each activity are provided following this exhibit.
Notes:
[1] Only applies to those systems eligible for and requesting a deferred SLR deadline.

g) ***Develop initial SLR Plan and submit to State for review (hrs_slr_plan_op).*** All systems with lead, GRR, and/or unknown service lines[128] must develop a plan for their SLR program that includes the following elements:

- A strategy for determining the composition of lead status unknown service lines in its inventory.
- A strategy for informing consumers and customers before a full or partial SLR.
- Procedures for coordinating the full SLR.
- A funding strategy for conducting SLR that includes ways to accommodate customers that are unable to pay to replace the portion of the service line they own.
- A strategy to prioritize LSR based on factors including, but not limited to, known lead and GRR service lines and community specific factors.
- A procedure for consumers and customers to flush service lines and premise plumbing of particulate lead following a disturbance or post-replacement.
- A communication strategy to inform both consumers and owners of rental properties with LSLs, GRR service lines, and service line of unknown material about the replacement program.
- Identification of any State and local laws and water tariff agreements relevant to the water system's ability to gain access to conduct full replacement.
- For systems that identify lead-lined galvanized service lines in their inventory, a strategy to determine the extent of the use of lead-lined galvanized service lines in the distribution system.

Also see activity i) for additional requirements for systems eligible for and requesting a deferred deadline.

The estimated burden is provided in Exhibit 4-85. The EPA assumed systems would require twice the burden to prepare the plan as for the State to review it. The State burden (*hrs_slr_plan_js*) is based on the ASDWA CoSTS model that assumes 6 hours for States to review the plan for small CWSs and NTNCWSs, 10 for medium CWSs, and 18 for large CWSs (ASDWA, 2020b; 2024).[129] ASDWA's estimates remained the same in their 2024 CoSTS model. See data variable *hrs_slr_plan_js* in Section 4.4.4.2, activity d) for assumptions used to derive that input. Note that the EPA developed a separate estimate for identifying funding options for SLR as described in the next activity.

[128] Section 3.3.4.1.1 in Chapter 3 presents the estimated percent of systems with known or potential lead content service lines. Note that the EPA grouped *all* systems with lead content together, so the values in Section 3.3.4.1.1 likely overestimate the percent and number of CWSs with known or potential lead and GRR service lines because they include lead connectors and galvanized pipe previously downstream of lead connectors.

[129] The EPA assumed large, medium, and small systems in ASDWA's CoSTS model corresponded to those size categories defined in the pre-2021 LCR as systems serving 50,000 or more people, 3,301 to 50,000 people, and 3,300 or fewer people, respectively.

Exhibit 4-85: Estimated Burden for Systems with Lead, GRR, and/or Unknown Service Lines to Develop an SLR Plan

System Size (Population Served)	*hrs_slr_plan_op*	
	CWSs	**NTNCWSs**
≤3,300	12	12
3,301-10,000	20	12
10,001-50,000	20	12
>50,000	36	12

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "LSLR Ancillary Costs_Final.xlsx."

h) ***Identify funding options for full SLRs (hrs_fin_op_op).*** The EPA assumes that CWSs with lead, GRR, and/or unknown service lines will incur additional burden to identify and evaluate funding options for SLR due to the complexities of financing SLR on private property. The burden for financial planning and identifying funding options for SLR was estimated at 400 to 1,100 hours per system in the proposed LCRI EA.

The proposed rule estimate was based on the estimate used for financial planning and identifying funding options from the Final 2021 LCRR EA (USEPA, 2020). Since the 2021 LCRR rule analysis was finalized, the EPA has provided additional technical assistance and guidance on funding sources for SLR. Specifically, In January 2023, the EPA announced the "Lead Service Line Replacement Accelerators" initiative (USEPA, 2023f). This major initiative is providing targeted technical assistance services to help underserved communities access funds from the BIL for the replacement of lead pipes that pose risks to the health of children and families. In December 2023, the EPA launched a new website titled "Identifying Funding Sources for Lead Service Line Replacement", available online at https://www.epa.gov/ground-water-and-drinking-water/identifying-funding-sources-lead-service-line-replacement. The EPA has also published SLR financing case studies, available online at https://www.epa.gov/ground-water-and-drinking-water/lslr-financing-case-studies, which were last updated in February 2024.

For the final LCRI EA, the EPA re-evaluated the previously identified sub-activities which make up the total burden estimate for identifying funding options in light of these new funding resources and technical support. This effort resulted in the EPA's holding one sub-activity constant, reducing two activities and eliminating the remainder of the sub-activities. In particular, the EPA maintained the burden from the proposed LCRI EA for evaluating potential legal considerations regarding the use of funding on private property. The agency reduced the burden for identifying and evaluating funding sources by half given the now available resources provide by the EPA. The agency removed all other financing steps including meeting with potential funding source, compiling a preliminary financing sub-activities, conducting public meetings and outreach, conducting a consumer income survey, and submitting pre-application for funding sources. These sub-activities were removed to avoid double counting the burden in activity g) for initial SLR plan development, and because they were beyond the scope of the initial SLR plan development. These updates resulted in a revised estimate of 68 to 170 hours as

a one time burden for CWS with lead, GRR, and/or unknown service lines to identify SLR funding options under the final LCRI and the 2021 LCRR (baseline). See Exhibit 4-86 for the breakdown of hours per system size category and activity.

Exhibit 4-86: PWS Burden to Identify Funding Options for SLRs

Planning Activity	Estimated Burden CWSs serving:		
	≤10,000	10,001-100,000	>100,000
Legal considerations for funding options. • Determine if statutes/regulations prohibit/restrict a public system from paying for SLRs on private property (*i.e.*, using public funds for private purposes). • Determine statutes/regulations prohibit/ restrict type of funding used for SLRs and if so, do they apply to system type (public vs. private) and SLR type (on public or private property).	8	16	20
Identify potential funding sources. • Consider grants, loans, or bonds or a combination; also consider other govt. support for low income homeowner-owned segments (e.g., HUD). Assume small systems have assistance identifying options. • Include State-specific options (such as MA's interest-free LSLR program through their State revolving fund (SRF)).	20	30	50
Evaluate funding sources. Determine if project meets criteria, funding and project timeline are compatible, impact on user charges, additional engineering or special studies required, affordability for users.	40	50	100
Totals	68	96	170

Acronyms: CWS = community water system; LSLR = lead service line replacement; SLR = service line replacement.
Source: "LSLR Ancillary Costs_Final.xlsx."

i) ***Include information on deferred deadline and associated replacement rate in the SLR plan (hrs_slr_plan_defer_op).*** Systems eligible for and requesting a deferred SLR deadline must also include in their initial SLR plan the following: (1) documentation of the system's eligibility for a deferred deadline; (2) documentation detailing the system's request for completing mandatory SLR under a deferred deadline, including the annual number of replacements required, the length of time (in years and months), the date of completion, and the associated cumulative average replacement rate considered to be the fastest feasible but no slower than the replacement rate corresponding to 39 annual replacements per 1,000 service connections; and (3) information supporting the system's request for a deferred deadline and why replacing lead and GRR service lines at a faster rate is not feasible. The EPA assumed that this burden would be 25 percent of the burden to develop the initial SLR plan, which is based on the ASDWA 2020 and 2024 CoSTS models (ASDWA 2020b; 2024). See Exhibit 4-87 below.

Exhibit 4-87: Estimated Additional Burden for the Initial SLR Plan Development for Systems Requesting a Deferred SLR Rate

System Size (Population Served)	*hrs_slr_plan_defer_op*	
	CWSs	NTNCWSs
3,300	3	3
3,301-10,000	5	3
10,001-50,000	5	3
>50,000	9	3

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "LSLR Ancillary Costs_Final.xlsx."
Notes: This additional burden only applies to systems requesting a deferred SLR rate.

j) ***Update SLR plan annually or certify no changes (hrs_slr_plan_update_op).*** All systems with lead, GRR, and/or unknown service lines must either: 1) update their SLR plan annually to include any changes that affect the system's ability to conduct mandatory full SLR, such as updates to relevant regulations (*e.g.,* State or local government laws associated with utility access), a new strategy for identifying materials of unknown service lines based on inventory validation, or lessons learned from risk communication efforts in the community; or 2) submit a certification of no change. The EPA assumed the majority of systems over time will not need to update their SLR program but instead will provide a certification of no change. Water systems may cease annual certifications to the State when there are no lead, GRR, and unknown service lines left in the inventory. The EPA assumed a lower burden for this requirement than needed to develop the initial SLR plan, which is in line other certification burden estimates using in this LCRI analysis, as shown in Exhibit 4-88 below.

Exhibit 4-88: Estimated Annual Burden for Systems to Update the SLR Plan or Certify No Changes

System Size (Population Served)	*hrs_slr_plan_update_op*	
	CWSs	NTNCWSs
≤3,300	2	2
3,301-10,000	3	2
10,001-50,000	4	2
>50,000	4	2

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "LSLR Ancillary Costs_Final.xlsx."
Notes: Systems with lead, GRR, or unknowns must annually update their SLR plan if they have a significant change or must instead certify to the State that they have no changes.

k) ***Provide an updated recommendation of the deferred deadline and associated replacement rate (hrs_defer_update_op).*** Systems with deferred deadlines, in addition to annual updates, must every

three years after the initial submission of the plan, update their replacement plan with the latest (1) documentation of the system's eligibility for a deferred deadline that shows that replacing 10 percent of the total number of known lead and GRR service lines (based on the replacement pool) results in the annual number of replacements per 1,000 service connections to exceed 39; (2) documentation detailing the system's request for completing mandatory SLR under a deferred deadline; and (3) information supporting the system's determination that the mandatory SLR rate is not feasible to meet and why replacing lead and GRR service lines at a faster rate is not feasible. . The EPA assumed that this burden would be 25 percent of the burden to develop the initial SLR plan, consistent with the burden for activity i) and shown in Exhibit 4-87.

Exhibit 4-89 provides the SafeWater LCR model costing approach for this activity including additional cost inputs that are required to calculate the total costs.

Exhibit 4-89: LSLR Plan Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
g) Develop initial SLR plan and submit to State for review				
The total hours per system multiplied by the system labor rate. *(hrs_slr_plan_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs with service lines of lead, GRR, and/or unknown service lines	One time
h) Identify funding options for full SLRs				
The total hours per system multiplied by the system labor rate. *(hrs_fin_op_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead, GRR, and/or unknown service lines	One time
i) Include information on deferred deadline and associated replacement rate in the SLR plan				
The total hours per system multiplied by the system labor rate. *(hrs_slr_plan_defer_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs seeking a deferral	One time
j) Update SLR plan annually or certify no changes				
The total hours per system multiplied by the system labor rate. *(hrs_slr_plan_update_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs with service lines of lead, GRR, and/or unknown service lines	Annually Starting in Year 4
k) Provide an updated recommendation of the deferred deadline and associated replacement rate				
The total hours per system multiplied by the system labor rate. *(hrs_defer_update_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs on a deferred SLR rate	Year 6 and triennially thereafter

Acronyms: CWS = community water system; GRR = galvanized requiring replacement; LSL = lead service line; SLR = service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:
[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] PWSs with lead content or unknown lines are identified using the data variables and approach described in Chapter 3, Section 3.3.4.

4.3.4.3 Physical Service Line Replacements

The final LCRI requires water systems to fully replace all lead and GRR service lines within 10 years unless the State has set a shorter schedule or approved a deferred deadline[130]. As discussed in Chapter 3, Section 3.3.4.3, several States already require PWSs to replace service lines with lead content. Since these requirements already exist, these State-required replacements[131] are not included in the cost or benefits of the final LCRI. For each PWS in a State with an existing SLR requirement, SafeWater LCR first calculates the number of SLs that would need to be replaced each year under the final LCRI absent any State requirement. These are known as the PWS's Federal SLRs. Next, SafeWater LCR calculates the number of SLs that would need to be replaced each year under the State requirements, absent any federal requirement. These are known as the PWS's State SLRs. SafeWater LCR then determines the PWS's Total SLR as the maximum of the Federal or State Replacements. Finally, SafeWater LCR calculates the PWS's SLRs due to the final LCRI as the difference between the PWS's Total SL replacements and the PWS's State SL replacements. Only the SL replacements due to the final LCRI are included in the cost and benefit estimates of the final rule. However, the PWS's Total SL replacements are tracked as they count towards the PWS's SL replacement requirement and total lines replaced in the system (i.e., some systems under more strict SL removal requirements may finish before the final LCRI 10 year deadline).

This section summarizes the EPA's cost estimates for physical replacement of service lines. Exhibit 4-90 summarizes cost estimate ranges for the physical full replacement and partial replacement of LSLs and the physical replacement of GRR service lines.

Exhibit 4-90: PWS LSLR Cost Estimates

Activity	Cost Estimate Range (2020$)	*SafeWater LCR Data Variable*
l) Systems replace lead or GRR service lines	Full: $6,507 - $8,519; Partial: $1,920 - $5,400; GRR: $1,920 - $5,400	*cost_lslr_lsl_reg_mand_pws;* *cost_lslr_partial_reg_pws;* *cost_lslr_gal_prev_lsl_reg_pws*

Acronyms: GRR = galvanized requiring replacement.
Source: "LSLR Unit Cost_Final.xlsx"

l) Systems replace service lines (cost_lslr_reg_mand_pws; cost_lslr_partial_reg_pws: cost_lslr_gal_prev_lsl_reg_pws). The EPA has developed estimates for a low and a high cost

[130] The 2021 LCRR and final LCRI both require water systems to replace lead connectors when encountered during normal operation. The EPA assumed that the incremental cost to meet this requirement is minimal because it is standard practice for water systems to use new connectors when replacing water mains or service lines.
[131] The States of Illinois, Michigan, New Jersey, and Rhode Island have passed State laws and regulations requiring mandatory service line replacement independent of their tap monitoring results.

scenario based on reported project data in the 7th DWINSA for full and partial replacements. These estimates are based on the 25th and 75th percentile data from 33 DWINSA reported projects. Note the estimated full and partial replacement costs include the cost of replacing the lead connectors. The detailed methodology for estimating the SLR unit costs is provided in Appendix A, Section A.2. See Section 4.2.2.2 for a discussion of how EPA modeled uncertainty in service line replacement unit costs using the 25th and 75th percentile.

Exhibit 4-91 provides the SafeWater LCR model costing approach for this activity including additional cost inputs that are required to calculate the total costs.

Exhibit 4-91: Lead Service Line Replacement Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
I) Systems replace lead and GRR service lines				
The sum of the number of lines replaced for each category of possible types of replacement multiplied by the costs per type of replacement. *(num_lslr_lsl_replace*cost_lslr_lsl_reg_mand_pws)+(num_lslr_partial_replace*cost_lslr_partial_reg_pws)+(num_lslr_gal_prev_lsl_replace*cost_lslr_gal_prev_lsl_reg_pws)*	Cost applies as written to NTNCWS.	All	Model PWS with known or potential lead content	Once a year[3]

Acronyms: AL = action level; CWS = community water system; LSL = lead service line; SLR = service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section.

[2] PWSs with lead content or unknown lines are identified using the data variables and approach described in Chapter 3, Section 3.3.4.1.

[3.] Replacement of lines occurs on an annual time step. Most lines are replaced in the period defined by the proposed LCRI, but some additional replacement occurs in the periods past the LCRI deadline based on systems meeting the deferred replacement requirements of the LCRI.

4.3.4.4 Ancillary Service Line Replacement Activities

The EPA has developed system costs for ancillary activities associated with SLR, as shown in Exhibit 4-92. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the State instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 4-92: PWS SL Replacement Ancillary Unit Burden and Cost Estimates

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
m) Contact customers and conduct site visits prior to SLR	Burden per replaced service line 1.70 to 2.07 hrs Cost per replaced service line $11.64 to $16.13/replaced LSL	Burden *hrs_replaced_lsl_contact_op* Cost *cost_replaced_lsl_contact*
n) Deliver filters and 6 months of replacement cartridges at time of SLR	$64.00/replaced service line	*cost_filter_hh*
o) Collect tap sample post-SLR	Burden per sample CWSs: 0.9 to 1.2 hrs NTNCWSs: 0.5 hrs Cost per sample per CWS Travel: $5.75 to $10.24 Bottle: $0 to $2.85	Burden *hrs_collect_lsl_lslr_op* Cost *cost_pickup_samp* *cost_other_lt_samp*[1]
p) Analyze post-SLR tap sample	In-house Analysis (CWSs > 100K only) Burden: 0.44 hrs/sample Cost: $3.92 Commercial Analyses $32.20/sample	In-house Analysis *hrs_analyze_lsl_lslr_op*[1] *cost_lab_lsl_lslr*[1] Commercial Analysis *cost_commercial_lsl_lslr*[1]
q) Inform customers of tap sample result	Burden CWSs: 0.05 -0.11 hrs/sample NTNCWSs: 1 hr/system Cost CWSs: $0.72/sample NTNCWSs: $0.079/system	Burden *hrs_inform_samp_op* *hrs_ntncws_cust_lslr_op* Cost *cost_cust_lslr* *cost_ntncws_cust_lslr*
r) Submit annual report on SLR program to State	1 to 8 hrs/CWS 1 hr/NTNCWS	*hrs_report_lcr_op*

Acronyms: CWS = community water system; HH = household; SL = service lines; SLR = service line replacement; NTNCWS = non-transient non-community water system.

Sources:

m) & r):"LSLR Ancillary Costs_Final.xlsx.

n): Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water (USEPA, 2023b)

o) – q) "Lead Analytical Burden and Costs_Final.xlsx."

Note:

[1] The burden and costs for these activities are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina (ASDWA, 2020a).

m) Contact customers and conduct site visits prior to SLR (hrs_replaced_lsl_contact_op, cost_replaced_lsl_contact). CWSs will incur burden and costs to coordinate with customers prior to replacing the SLs. The estimated burden and costs are provided in Exhibit 4-93 and Exhibit 4-94, respectively.

Exhibit 4-93: Estimated Burden Associated with Contacting Customers and Site Visit Prior to LSLR (hours/replaced SL) *(hrs_replaced_lsl_contact_op)*

System Size (Population Served)	Upfront Contact		Site Visit Travel			On-Site Review	Total Burden
	Phone Call	Prepare Letter	Miles one way	Time one way (hrs)	Time Roundtrip (hrs)		
	A	B	C	D	E = D*2	F	G = A+B+E+F
≤3,300	0.25	0.05	5.0	0.20	0.40	1	**1.70**
3,301-100,000	0.25	0.11	5.0	0.20	0.40	1	**1.76**
100,001-1,000,000	0.25	0.11	6.4	0.26	0.51	1	**1.87**
>1,000,000	0.25	0.11	8.9	0.36	0.71	1	**2.07**

Source: "LSLR Ancillary Costs_Final.xlsx," worksheet "Customer Coordination."
Notes:
A & B: For each SLR, the EPA assumed a system will first contact customers twice. These contacts are to coordinate a site visit to confirm the presence of a SL requiring replacement prior to the actual replacement of the line that are found to be lead. The EPA assumed the system first calls the customer (15 minutes per customer) and then sends a certified letter. Burden to prepare the letter is 1 hour 20 letters for systems serving 3,300 or fewer people and 1 hour per 9 letters for those serving more than 3,300 people, based on the 2022 *Disinfectants and Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 29 - Notification of Sampling Results for Customers Whose Taps Are Sampled (Note G) (USEPA, 2022a).
C - E: Based on census data and zip codes from the 2006 Community Water System Survey. See file "Estimated Driving Distances_Final.xlsx." EPA assumed an average speed of 25 miles per hour, round trip.
F: Includes 1 hour for on-site visual inspection. Assumed no testing.

Exhibit 4-94: Estimated Non-Labor Costs Associated with Contacting Customers and Site Visit Prior to SLR ($/replaced SL) *(cost_replaced_lsl_contact)*

System Size (Population Served)	Mailing Costs			Vehicle O&M			Total Cost
	Certified Mail	Paper	Envelopes	Miles Roundtrip	2016 Mileage Rate	Cost per Trip	
	A	B	C	D	E	F = D * E	G = A+B+C+F
≤100,000	$5.80	$0.017	$0.076	10	$0.575	$5.75	**$11.64**
100,001-1,000,000	$5.80	$0.017	$0.076	12.8	$0.575	$7.36	**$13.25**
> 1,000,000	$5.80	$0.017	$0.076	17.8	$0.575	$10.24	**$16.13**

Source: "LSLR Ancillary Costs_Final.xlsx," worksheet "Customer Coordination."
Notes:
A: Includes certified mail cost ($3.55), emailed signature receipt ($1.70), and first class postage ($0.55). See https://pe.usps.com/Archive/NHTML/DMMArchive20201018/Notice123.htm#_c037 (accessed 1/5/22).
B&C: Based on quotes from 3 vendors. See file, "General Cost Model Inputs_Final.xlsx" for additional detail.

D: Vehicle O&M based on 25 mph and Federal reimbursement rate of $0.575 (2020 mileage rate. See https://www.gsa.gov/travel/plan-book/transportation-airfare-pov-etc/privately-owned-vehicle-mileage-rates/pov-mileage-rates-archived#auto. Accessed 1/17/2022.

n) ***Deliver filters and 6 months of replacement cartridges at time of SLR (cost_filter_hh).*** Systems must provide a pitcher filter (*i.e.*, pour through filter) or point-of-use device that is certified to remove lead to each resident following any lead or GRR SLR. The EPA assumed that the pitchers and filters delivered to each resident to use for six months following a replacement will cost $64 on average (including shipping and filter replacement). See *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b) for additional detail.

o) ***Collect tap sample post-SLR (hrs_collect_lsl_lslr_op, cost_pickup_samp, cost_other_lt_samp).*** All systems must collect one sample following replacement of each lead or GRR service line (*numb_samp_lslr*). Burden and costs for this activity are different than mandatory tap sampling because the system collects the sample after replacement as opposed to the tap sampling program in which the customer collects the sample. Exhibit 4-95 and Exhibit 4-96 provide the estimated CWS burden and cost to collect these samples. A discussion of the burden and costs to NTNCWSs follow these exhibits.

Exhibit 4-95: CWS Unit Burden to Collect Post-SLR Tap Sample

System Size (Population Served)	Burden (hrs/Sample)		
	Round-trip travel to customer's home	Sample Collection Burden	Total Sample Collection Burden
			hrs_collect_lsl_lslr_op
	A	B	C = A+B
≤100,000	0.40	0.5	**0.9**
100,001-1,000,000	0.51	0.5	**1.0**
>1,000,000	0.71	0.5	**1.2**

Source: "Lead Analytical Burden and Costs_Final.xlsx," worksheet, "LSLR_CollectAnaly_CWS_LCRR_LCRI."
Notes:
A: Based on census data and zip codes from the 2006 Community Water System Survey, the EPA assumed the following one-way driving distances for CWSs: 5.0 miles serving ≤ 100,000 people, 6.4 miles serving 100,001 - 1M, and 8.9 miles for > 1M. These distances were doubled to estimate roundtrip mileage. See file, "Estimated Driving Distance_Final.xlsx" for additional detail on how these estimates were derived. The EPA assumed an average speed of 25 miles per hour.
B: The EPA assumed the same collection burden following LSLR as for source water sample collection, which is based on the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 15, Average Labor Hrs. for Collection (Per Sample) (USEPA, 2022a).

Exhibit 4-96: CWS Non-labor Unit Cost to Collect Post-SLR Tap Sample

System Size (Population Served)	Cost (hrs/Sample)	
	Round-trip travel to customer's home	Bottle Cost
	cost_pickup_samp	*cost_other_lt_samp*
	A	B
≤100,000	$5.75	$0.00

System Size (Population Served)	Cost (hrs/Sample)	
	Round-trip travel to customer's home	Bottle Cost
	cost_pickup_samp	*cost_other_lt_samp*
100,001-1,000,000	$7.36	$2.85
>1,000,000	$10.24	$2.85

Source: "Lead Analytical Burden and Costs_Final.xlsx," worksheet, "LSLR_CollectAnaly_CWS_LCRR_LCRI."
Notes:
A: Based on census data and zip codes from the 2006 Community Water System Survey, assumed the following one-way driving distances for CWSs: 5.0 miles serving ≤ 100,000 people, 6.4 miles serving 100,001 - 1M, and 8.9 miles for > 1M. These distances were doubled to estimate roundtrip mileage. See file, "Estimated Driving Distance_Final.xlsx" for additional detail on how these estimates were derived. The EPA assumed an average speed of 25 miles per hour and used the Federal reimbursement rate of $0.575 (2020 mileage rate).
B: Bottles are included as part of the commercial laboratory fee. Only CWSs serving more than 100,000 people are assumed to conduct analyses in-house for lead. For a detailed discussion of the assumptions used to estimate bottle costs, see file "Lead Analytical Burden and Costs_Final.xlsx," worksheet, "Sample Kit_Bottle_$."

NTNCWSs will not incur the burden or costs to travel to a customer's house to collect a sample. In addition, NTNCWSs do not incur bottle costs because laboratories provide the 1-liter bottle as part of their commercial laboratory fee. Thus, they will only incur a burden of 0.5 hours per sample and $0 costs associated with sample collection.

p) ***Analyze post-LSLR tap sample (hrs_analyze_lsl_lslr_op, cost_lab_lsl_lslr, cost_commercial_lsl_lslr).*** As previously discussed in Section 4.3.2.1.2, activity k), the EPA assumed CWSs serving more than 100,000 people will conduct lead analyses in-house and require 0.44 hours per sample based on estimates provided by three laboratories (*hrs_analyze_lsl_lslr_op*). These systems will also incur consumable costs of $3.92 per sample based on information from three vendors (*cost_lab_lsl_lslr*). The remaining CWSs and all NTNCWSs are assumed to use commercial laboratories and incur a cost of $23.50 per lead sample based on quotes from seven laboratories plus a per sample shipping cost of $8.70 for a total per sample cost of $32.20 (*cost_commercial_lsl_lslr*). Note that although the data variable names are different, the unit costs for lead sample analysis are the same as for lead tap sampling as presented in Section 4.3.2.1.2.

q) ***Inform customers of tap sample result (hrs_inform_samp_op, cost_cust_lslr, hrs_ntncws_cust_lslr_op, cost_ntncws_cust_lslr).*** Systems must notify their customers of their lead analytical results from the sample collected following SLR. The EPA made the following assumptions regarding the burden and/or costs for this notification:

- CWSs of all sizes will send the results to their customers at a per sample burden of 0.05 hours (1 hour per 20 letters) for CWSs serving 3,300 or fewer people and 0.11 hours (1 hour per 9 letters) for CWSs serving > 3,300 people *(hrs_inform_samp_op)* and a cost of $0.72 *(cost_cust_lslr)*. These inputs are the same as those used for the tap sampling program. The burden estimates are based on the public education burden for systems to notify occupants of results estimated in the 2022 Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal), Exhibit 29 (Note G) (USEPA, 2022a). Systems are also assumed to mail the post-LSLR sample results. The cost consists of postage ($0.55), paper ($0.019), ink ($0.06), and envelope ($0.092) for a total cost of $0.72/sample. See file,

"General Cost Model Inputs_Final.xlsx" for additional information on the sources of these estimates.

- NTNCWSs are assumed to notify the people they serve electronically and through posting. The EPA assumed all NTNCWSs of all size categories will spend 0.5 hours to develop/send e-mail and an additional 0.5 hours to post the notification publicly for a total of burden 1 hour per system (*hrs_ntncws_cust_lslr_op)*. In addition, NTNCWSs will incur material costs for paper posting of $0.079 based on quotes from three vendors *(cost_ntncws_cust_lslr)*. See derivation file, "General Cost Model Inputs_Final.xlsx" for quotes.

r) ***Submit annual report on SLR program to State (hrs_report_lcr_op).*** No later than 30 days after the end of each replacement program year, systems must submit SLR program information to their State including the location of each lead and GRR service line and lead connector replaced, the number of unknown service lines determined to be non-lead, the number of unknown service lines remaining, their replacement schedule, and other information as required under § 141.90(e). The EPA assumed that systems will submit this information in the form of an annual report. The EPA estimated that burden would be higher as system size increases to account for larger the number of SLRs. The EPA estimated the following burden for CWSs to prepare and submit their annual report:

- CWSs serving 3,300 or fewer and NTNCWSs: 1 hour.
- CWSs serving 3,301 to 10,000 people: 2 hours.
- CWSs serving 10,001 to 100,000 people: 4 hours.
- CWSs serving more than 100,000 people: 8 hours.

Exhibit 4-97 provides the SafeWater LCR model cost estimation approach for PWS ancillary LSLR activities including additional cost inputs that are required to calculate these costs.

Exhibit 4-97: Service Line Inventory Ancillary Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
m) Contact customers and conduct site visits prior to SLR				
The number of lines replaced multiplied by the total of the hours per lead line replacement times the system labor rates, plus the material cost. *num_lsl_replace * (hrs_replaced_lsl_contact_op * rate_op + cost_replaced_lsl_contact)*	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead content	Once a year
n) Deliver filters and 6 months of replacement cartridges at time of SLR				
The number of lines replaced multiplied by the material cost. *num_lsl_replace*cost_filter_hh*	Cost applies as written to NTNCWSs.	All	Model PWSs with service lines of lead content	Once a year
o) Collect tap sample post-SLR[3]				
The number of samples per replaced lead line multiplied by the number of lines replaced, multiplied by the total of the hours per lead line replacement times the system labor rates, plus the material cost. *(numb_samp_lslr*num_lsl_replace)*((hrs_collect_lsl_lslr_op*rate_op)+cost_other_lt_samp+cost_pickup_samp)*	Cost applies as written to NTNCWSs.	All	Model PWSs with service lines of lead content	Once a year
p) Analyze post-LSLR tap sample[3]				
The number of samples multiplied by the probabilities for a sample analyzed in house and a sample analyzed in a commercial lab times the different labor and material cost burdens for each type of analysis. *(((numb_samp_lslr*num_lsl_replace)*pp_lab_samp)*((hrs_analyze_lsl_lslr_op*rate_op)+cost_lab_lsl_lslr))+(((numb_samp_lslr*num_lsl_replace)*pp_commercial_samp)*cost_commercial_lsl_lslr)*	Cost applies as written to NTNCWSs.	All	Model PWSs with service lines of lead content	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
q) Inform customers of the tap sample result				
The number of lines replaced multiplied by the total of the hours per line replacement times the system labor rates, plus the material cost. *num_lsl_replace*((hrs_inform_samp_op*rate_op)+cost_cust_lslr)*	The total hours per system times the system labor rates, plus the material cost. *(hrs_ntncws_cust_lslr_op*rate_op)+cost_ntncws_cust_lslr)*	All	Model PWSs with service lines of lead content	Once a year
r) Submit annual report on SLR program to State				
The total hours for reporting per system multiplied by the system labor rate. *(hrs_report_lcr_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWSs that are replacing lead service lines or GRR	Once a year

Acronyms: AL = action level; CWS = community water system; GRR = galvanized requiring replacement; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *pp_lab_samp*: Likelihood of in-house analysis (Section 4.3.2.1.2, activity k)).
- *pp_commercial_samp*: Likelihood of commercial lab analysis (Section 4.3.2.1.2, activity k)).
- *rate_op*: PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] PWSs with lead content or unknown lines are identified using the data variables and approach described in Chapter 3, Section 3.3.4.

[3] The burden and costs to provide sample bottles (*cost_other_lt_samp*) under activity o) and conduct analyses under activity p) are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina (ASDWA, 2020a).

4.3.4.5 Estimate of national service line testing and replacement costs

Exhibit 4-98 shows the estimated annualized national cost, under the low and high cost scenarios, of developing the SL inventory, and conducting the required SLR programs under the 2021 LCRR, the final LCRI, and the monetized incremental cost discounted at 2 percent. The incremental annual costs range from $1.2 billion to $1.6 billion in 2022 dollars. Eighty-eight percent of the costs associated with the SL replacement program is spent on actual SLRs.

Exhibit 4-98: Estimated National Annualized Lead Service Line Replacement Costs - 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
LSL Inventory	$60.9	$78.6	$17.7	$60.9	$78.4	$17.5
System SLR Plan	$3.1	$17.0	$13.9	$5.8	$17.0	$11.2
System SLR	$12.1	$1,104.7	$1,092.6	$44.7	$1,610.0	$1,565.3
SLR Ancillary Activities	$8.5	$58.7	$50.2	$13.1	$58.5	$45.4
Total PWS SLR Program Costs	***$84.6***	***$1,259.0***	***$1,174.4***	***$124.5***	***$1,763.9***	***$1,639.4***
Household SLR Costs	$8.1	$0.0	-$8.1	$26.4	$0.0	-$26.4
Total Annual Lead Service Replacement Costs	**$92.7**	**$1,259.0**	**$1,166.3**	**$150.9**	**$1,763.9**	**$1,613.0**

Acronyms: LCRI = Lead and Copper Rule Improvements; LSL = lead service line; PWS = public water system; SLR = service line replacement; USD= United States dollar.
Notes: The EPA in the Final 2021 LCRR EA (USEPA, 2020) assumed that the cost of customer-side SLRs made under the goal-based replacement requirement would be paid for by households. The agency also assumed that system-side SLRs under the goal-based replacement requirement and all SLRs (both customer-side and systems-side) would be paid by the PWS under the 3 percent mandatory replacement requirement. The EPA made these modeling assumptions based on the different levels of regulatory responsibility systems faced operating under a goal-based replacement requirement versus a mandatory replacement requirement. While systems would not be subject to a potential violation for not meeting the replacement target under the goal-based replacement requirement, under the 3 percent mandatory replacement requirement the possibility of a violation could motivate more systems to meet the replacement target even if they had to adopt customer incentive programs that would shift the cost of replacing customer-side service lines from customers to the system. To be consistent with these 2021 LCRR modeling assumptions, under the final LCRI, the EPA assumed that mandatory replacement costs would fall only on systems. Therefore, the negative incremental values reported for the "Household SLR Costs" category do not represent a net cost savings to households. They represent an assumed shift of the estimated SLR costs from households to systems. The EPA has insufficient information to estimate the actual SLR cost sharing relationship between customers and systems at the national level of analysis. The EPA also recognizes that the cost estimates shown may overestimate the annualized costs due to differences in timing between LCRI SLR requirements and activities in the SafeWater model. The final LCRI defines the first mandatory service line replacement year as being from the compliance date of the rule to the end of the next calendar year. For this economic analysis, EPA divides the period of analysis into 12-month periods, representing one year, beginning on the effective date of the rule. Thus, the SafeWater model predicts that costs will be incurred on a slightly earlier schedule than is required in the final LCRI resulting in an overestimate of annualized costs.

4.3.5 PWS POU-Related Costs

Under the final LCRI, CWSs serving 3,300 or fewer people and NTNCWSs with a lead 90th percentile above the AL of 10 µg/L must evaluate and recommend to their State which compliance option they will implement from among CCT installation/re-optimization, or the compliance alternatives POU device installation and maintenance or replacement of lead-bearing materials. For modeling purposes, the EPA assumed that systems would choose the least costly option from among the first two alternatives.

Because of the wide variety of plumbing configurations in individual homes and buildings among different water systems, it was not possible to estimate burden and costs for replacing lead-bearing materials. The SafeWater LCR model calculates the annualized cost the system will face under these two options and selects the least costly alternative.

Those systems approved for the POU provision must develop a plan and implement the program. Note that once the POU option is started, the system must continue to implement this program even if they no longer exceed the lead AL in the future.

In addition to the cost to provide and maintain POU devices and educate customers on them, systems have associated ancillary public education and sampling costs. POU-related costs are grouped into two subsections:

- 4.3.5.1: POU Device Installation and Maintenance
- 4.3.5.2: POU Ancillary Activities

In addition, Section 4.3.5.3 provides the national annualized POU costs under the low cost and high cost scenarios at a 2 percent discount rate.

4.3.5.1 POU Device Installation and Maintenance

All costs in this category are grouped into one activity: a) provide, monitor, and maintain POU devices.

a) Provide, monitor, and maintain POU devices (annual_pou_cost_hh). CWSs approved for the POU program must provide one POU device at each household they serve and continue to maintain the device. The EPA determined the average number of households per system, which is equivalent to the number of POU devices by dividing the retail population served by all systems in each of the four size categories serving 3,300 people or fewer people (*pws_pop*) by the average number of people per household (2.53 *(numb_hh)*) and then dividing by the number of systems per size category, as shown in Exhibit 4-99. Note that a CWS that serves a non-residential building would also need to provide a POU device for each tap used for cooking and/or drinking. For modeling purposes, the EPA did not account for POU devises at non-residential buildings within the CWS service area, which will underestimate costs for the CWSs that serve non-residential buildings.

Exhibit 4-99: Average Number of Households and POU Devices per CWS

System Size (Population Served)	# of Systems	Retail Population	Households (HH) per System Size Category	Average HH per System (Equals Number of POU Devices)
		pws_pop		
	A	B	C = B/2.53	D = C/A
≤100	11,732	708,236	279,935	**24**
101-500	15,084	3,830,126	1,513,884	**100**
501-1,000	5,330	3,931,488	1,553,948	**292**

System Size (Population Served)	# of Systems	Retail Population	Households (HH) per System Size Category	Average HH per System (Equals Number of POU Devices)
		pws_pop		
	A	B	C = B/2.53	D = C/A
1,001-3,300	7,967	15,218,647	6,015,275	**755**

Acronyms: HH = household; POU = point-of-use.
Notes:
A,B: SDWIS/Fed fourth quarter 2020 "frozen" data set that includes information reported through December 31, 2020.
C: 2.53 is the average number of people per household for the year 2020 (U.S. Census Bureau, 2020). Table AVG1. Average Number of People Per Household, By Race and Hispanic Origin, Marital Status, Age, And Education of Householder: 2020. This corresponds to SafeWater data variable: *numb_hh*.

NTNCWSs must provide a POU device on each tap used for cooking and/or drinking water consumption. Exhibit 4-100 provides the estimated number of POU devices per NTNCWS based on 11 types of NTNCWS service categories classified under five Internal Plumbing Code (IPC) categories (business, industrial, residential, daycare, and school). Two estimates are provided, a minimum that excludes the installation of POU on bathroom taps and a maximum that includes bathroom taps. Additional detail on the EPA's approach is provided in "POU Inputs_Final.xlsx."

Exhibit 4-100: Minimum and Maximum Estimated Number of Taps Requiring POU Devices per NTNCWS

System Size (Population Served)	Minimum Number of POU Devices	Maximum Number of POU Devices
	numb_pou	
	A	B
≤100	3	9
101-500	5	23
501-1,000	9	54
1,001-3,300	16	121
3,301-10,000	41	427
10,001-50,000	150	1,452
50,001-100,000	114	594
100,001-1,000,000	306	1,666
> 1,000,000		

Acronyms: POU = point-of-use.
Source: "POU Inputs_Final.xlsx."
Notes:
A: The minimum number of POU devices is based on the weighted average of the number of taps excluding bathrooms. See Table A-1 in "POU Inputs_Final.xlsx," worksheet "NTNCWS_Cost Model_Inputs."

B: The maximum number of POU devices is based on the weighted average of number of taps including bathrooms. See Table A-2 in "POU Inputs_Final.xlsx," worksheet "NTNCWS_Cost Model_Inputs."

The number of POU devices *(numb_pou)* is multiplied by the unit cost of the POU device installation and maintenance (*annual_pou_cost_hh*) to produce the total cost. The EPA used a modified version of the WBS model to calculate unit costs for POU devices that specifically remove lead. The WBS model includes the following cost components of a complete POU program:

- POU device purchase, and scheduling and installation labor;
- Labor for POU device maintenance; and
- Materials (replacement filters) for POU device maintenance.

The EPA assumed 25 percent of households receive countertop units and 75 percent receive faucet mount units. The associated annual average cost is $104 per household per year. The derivation of this unit cost (*annual_pou_cost_hh*) is shown in detail in *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b).

Exhibit 4-101 provides the SafeWater LCR model costing approach for installation and maintenance of POU devices including additional cost inputs that are required to calculate these costs.

Exhibit 4-101: Point-of-Use Device Installation and Maintenance Cost Estimation in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th – Range[1]	Other Conditions	
a) Provide, monitor, and maintain POU devices				
Households per system multiplied by the unit cost of the POU device installation and maintenance. *(pws_pop/numb_hh)*annual_pou_cost_hh*	The number of POU devices per system multiplied by the unit cost of the POU device installation and maintenance. *numb_pou*annual_pou_cost_hh*	All	Model PWS installing a POU device	Once per year

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.

Notes:

[1] Once the POU option is started in response to exceeding the lead AL, systems must continue to implement this program regardless of their subsequent lead 90th percentile levels. POU installation occurs once with O&M costs continuing annually.

4.3.5.2 POU Ancillary Activities

The EPA has developed costs for one-time ancillary PWS activities related to POU program development and on-going ancillary activities as shown in Exhibit 4-102. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of each activity follows the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. In a few instances, some of these activities are conducted by the State instead of the water system. These activities are identified in the exhibit and further explained in the exhibit notes.

Exhibit 4-102: PWS Ancillary POU-Related Burden and Cost Estimates[1]

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
b) Develop POU plan and submit to the State (one-time)[2]	178 to 328 hrs for CWSs; 148 to 388 hrs for NTNCWSs	*hrs_pou_plan_dev_op*
c) Develop public education materials and submit to the State (one-time)	7 hrs per CWS and NTNCWS	*hrs_pe_pou_op*
d) Print POU education materials	Burden 0.0025 hrs/sample per CWS 1 hr/NTNCWS Cost $0.079 sample per CWS and NTNCWS	Burden *hrs_print_pe_pou_op* *hrs_ntncws_distr_pe_pou_op* Cost *cost_print_pe_pou* *cost_ntncws_distr_pe_pou*
e) Obtain households for POU monitoring	0.5 hrs per sample for CWSs only	*hrs_samp_volunt_pou_op*
f) Deliver POU monitoring materials and instructions to participating households	Burden 0.25 hrs/sample per CWS Cost $8.77 sample per CWS $0 per NTNCWS	Burden *hrs_discuss_samp_op* Cost *cost_pou_samp*[3]
g) Collect tap samples after POU installation	CWS Burden: 0.40 hrs/sample Cost: $5.75 NTNCWS 0.5 hrs/sample	CWS *hrs_pickup_samp_op* *cost_pickup_*samp NTNCWS *hrs_source_op*
h) Determine if sample should be rejected and not analyzed	0.25 hrs/rejected sample for CWSs only	*hrs_samp_reject_op*
i) Analyze POU tap samples	In-House Burden N/A In-House Cost N/A Commercial Analysis $32.30/ sample per CWS and NTNCWSs	In-House Burden *hrs_analyze_samp_op*[3] In-House Cost *cost_lab_lt_samp*[3] Commercial Analysis *cost_commerical_lab*[3]

Activity	Unit Burden and/or Cost	SafeWater LCR Data Variable
j) Prepare and submit sample invalidation request to the State	2 hrs per sample per CWS and NTNCWS	*hrs_samp_invalid_op*
k) Inform customers of POU tap sample results	CWS Burden: 0.05 hrs/sample Cost: $0.72/sample NTNCWS Burden: 1 hr/sample Cost: $0.079/sample	CWS *hrs_inform_samp_op* *cost_cust_lt* NTNCWS *hrs_ntncws_inform_samp_op* *cost_ntncws_cust_lt*
l) Certify to the State that POU tap results were reported to customers	0.66 hrs/year per CWS; 0.66 to 1 hr/year for NTNCWS	*hrs_cert_cust_lt_op*
m) Prepare and submit annual report on POU program to the State	1 hr per CWS; 1 to 8 hrs per NTNCWS	*hrs_pou_report_ann_prep_op*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use.

Sources:

b) & m) "POU Inputs_Final.xlsx", worksheets "CWS_Cost Model Inputs" and "NTNCWS_Cost Model Inputs", worksheet, "POU Outreach."

c) & d) Public Education Inputs_CWS_Final.xlsx; Public Education Inputs_NTNCWS_Update.xlsx.

e) – l): Lead Analytical Burden and Costs_Final.xlsx, worksheets "POU_Collect_Analyze_LCRR_LCRI" and "POU_Sample_Report_LCRR_LCRI."

Notes:

[1] Requirements apply only to CWSs serving 3,300 or fewer people and NTNCWSs that exceed the AL and have POU provision and maintenance as their approved compliance option.

[2] The rule does not explicitly include a POU plan. However, the EPA assumed most systems would prepare this plan prior to implementing a POU program. This assumption may overestimate costs during the first year the program is implemented.

[3] In Arkansas, Louisiana, Mississippi, Missouri, and South Carolina, the State pays for the cost of bottles, shipping, analysis, and providing sample results to the system (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities in lieu of the system.

b) ***Develop POU plan and submit to the State (hrs_pou_plan_dev_op).*** Although not required under the final LCRI, the EPA assumed that systems (*i.e.*, CWSs serving 3,300 or fewer people and NTNCWSs without CCT[132]) above the AL that select the POU option would develop a plan to provide and maintain POU devices for lead removal. The EPA assumed the POU plan would include gathering background information and identifying plan elements, customer participation (CWSs only), installation, monitoring and maintenance, and logistics and administration. Each of these plan elements are included in the overall burden estimate and provided in Exhibit 4-103 and Exhibit 4-104 for CWSs and NTNCWSs, respectively.

Additional detail on each of these plan elements is provided in the file, "POU Inputs_Final.xlsx."

[132] The proposed LCRI does not prohibit systems with CCT from selecting the POU option. However, the EPA assumed systems would re-optimize their CCT.

Exhibit 4-103: CWS Burden to Develop a POU Plan (hrs/system)
hrs_pou_plan_dev_op

System Size (Population Served)	Gather Background Information	Plan for Customer Participation	Plan for Installation	Plan for Monitoring & Maintenance	Plan for Logistics & Administration	Total
	A	B	C	D	E	F=A:E
≤100	58	30	30	50	10	**178**
101-500	58	30	30	50	10	**178**
501-1,000	108	60	60	100	0	**328**
1,001-3,300	108	60	60	100	0	**328**

Source: "POU Inputs_Final.xlsx." This file provides the associated burden for the activities listed in Notes A - E.
Notes:
General:
1. Under the final LCRI, the POU provision for CWSs is only available to those that serve 3,300 or fewer people.
2. With the exception of reading the guidance (see note A) and planning for logistics and administration (see note E), CWSs serving more than 500 people are assumed to incur twice the burden than those serving 500 or fewer people.

A: Includes read and understand "POU or point of entry (POE) Treatment Options for Small Drinking Water Systems" (USEPA, 2006b) and identify considerations and options for their appropriate system type; prepare a draft outline of plan elements and submit for management and State approval, as applicable; present a draft outline of plan elements to system board/management bodies and incorporate feedback; and consult with a legal expert on property liability and additional insurance.
B: Includes identifying in the plan the types of customer access and maintenance agreements needed and their schedule for development; includes 2 hours of legal consultation.
C: Includes identifying the number of taps to treat and the schedule and customer priority for installation; identifying whether vendors or licensed plumbers, and certified operators will install the units and how they will be managed and tracked; and how and when arrangements for access to installation sites will occur and how they will be managed and tracked.
D: Includes description of vendor responsibilities and utility responsibilities for monitoring and maintenance of the POU units; unit maintenance frequencies and checklist for maintenance inspections; POU unit routine replacement frequencies and protocol for emergency reporting of problems and response; and incorporation of rule-specific monitoring requirements into the plan.
E: Includes description of contractual agreements and oversight responsibilities for lease agreements. Assumed this primarily affects CWSs serving 500 and fewer people because they would not have available staff for maintenance and monitoring of these units.

Exhibit 4-104: NTNCWS Burden to Develop a POU Plan (hours/system)
hrs_pou_plan_dev_op

System Size (Population Served)	Gather Background Information	Plan for Customer Participation	Plan for Installation	Plan for Monitoring & Maintenance	Plan for Logistics & Administration	Total
	A	B	C	D	E	F=A:E
≤500	58	0	30	50	10	**148**
501-10,000	108	0	60	50	10	**228**
10,001-50,000	208	0	120	50	10	**388**
50,001- 1,000,000	108	0	60	50	10	**228**

Source: "POU Inputs_Final.xlsx."

Notes:
General: No NTNCWS serves more than 1 million people. Two NTNCWSs serve 50,001 – 1,000,000 people. These systems have fewer taps than the average estimated number for those serving 10,001 - 50,000 people. Thus, the EPA assumed a similar burden for these two largest NTNCWSs as those serving 3,301 - 10,000 people.
A: Includes read and understand "POU or POE Treatment Options for Small Drinking Water Systems" (USEPA, 2006b) and identify considerations and options for their appropriate system type; prepare a draft outline of plan elements and submit for management and State approval, as applicable; present a draft outline of plan elements to governing bodies and incorporate feedback; and consult with a legal expert on property liability and additional insurance.
B: Does not apply to NTNCWSs.
C: Includes identifying the number of taps to treat and the schedule for installation; identifying whether vendors or licensed plumbers, and electricians will install the units and how these services will be provided; and how and when arrangements for access to installation sites will occur and how they will be managed and tracked.
D: Includes description of vendor responsibilities for monitoring and maintenance of the POU units; unit maintenance frequencies and checklist for maintenance inspections; POU unit routine replacement frequencies and protocol for emergency reporting of problems and response; and incorporation of rule-specific monitoring requirements into the plan.
E: Includes description of contractual agreements and oversight responsibilities for lease agreements.

c) ***Develop public education materials and submit to the State (hrs_pe_pou_op).*** CWSs serving 3,300 or fewer people and NTNCWSs with a lead ALE that choose the POU option must implement the POU program including providing public education on the maintenance and use of POU device to all households they serve. The EPA assumed these systems will incur a one-time burden of 7 hours to develop these public education materials and submit them to the State for review *(hrs_pe_pou_op*). The burden estimate of 7 hours is based on the hours to prepare additional brochure language from Exhibit 33a of the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* ***(***USEPA, 2022a).

d) ***Print POU education materials (hrs_print_pe_pou_op, cost_print_pe_pou, hrs_ntncws_distr_pe_pou, cost_ntncws_distr_pe_pou).*** The EPA estimated CWSs serving 3,300 or fewer people will require 0.0025 hours per household to print POU public education materials based on assumptions for production labor used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule*, Exhibit 17 (USEPA, 2007). The EPA assumed that this material would be provided in addition to the manufacturer's information that comes with the POU device. The estimated cost for systems to print POU public education material per household is $0.079 that is the cost of paper and ink. The EPA assumed that there will be no envelope or mailing costs because public education materials will be provided when the system provides the POU device. See "General Cost Model Inputs_Final.xlsx" for specific vendor paper and ink quotes. The EPA assumed NTNCWSs would provide materials via email and post materials publicly with an estimated burden of 0.5 hours to develop/send e-mail and an additional 0.5 hours to post the materials, for a total of 1 hour (*hrs_ntncws_distr_pe_pou_op*). NTNCWSs will also incur a cost for public education posted materials (*cost_ntncws_distr_pe_pou*) that will include paper and ink costs of $0.079, which is the same case as that assumed for CWSs).

e) ***Obtain households for POU monitoring (hrs_samp_volunt_pou_op).*** Under the POU program, systems must sample one-third of locations with POU devices annually. For CWSs, the EPA assumed customers can collect these samples. The EPA estimated that a CWSs will incur a burden of 0.5 hours to obtain customers for POU sampling. The EPA also applied the same inflation percentages, from

the assumption associated with lead tap sampling, to the number of required POU samples to account for the likelihood a customer does not collect the sample (10 percent, 1 - *pp_hh_return_samp*), the sample is rejected (5 percent, *pp_samp_reject*), or invalidated (0.6 percent, *pp_samp_invalid*). Refer to Section 4.3.2.1.2, activity f) for additional detail.

f) ***Deliver POU monitoring materials and instructions to participating households (hrs_discuss_samp_op, cost_pou_samp).*** The EPA used the same data variables and inputs for CWSs to discuss proper sampling procedures with customers of 0.25 hours per sample (*hrs_discuss_samp_op*) as under the lead tap program. The EPA also assumed systems will incur the same non-labor costs to provide a test kit to customers (*cost_pou_samp*) of $8.77 for CWSs serving 3,300 or fewer people as used for systems without LSLs under the tap sampling program (*cost_5_lt_samp*). (See Exhibit 4-12.) EPA also applied the same inflation percentages to the number of samples to account for the likelihood a customer does not collect the sample (1 - *pp_hh_return_samp*), the sample is rejected (*pp_samp_reject*), or invalidated (*pp_samp_invalid*). Refer to Section 4.3.2.1.2, activities f) and h) for additional detailed assumptions.

g) ***Collect tap samples after POU installation (hrs_pickup_samp_op, cost_pickup_samp, hrs_source_op).*** The EPA uses the same data variable and input for the burden and O&M cost for CWSs serving 3,300 or fewer to travel to a customer's home to pick-up the collected sample of 0.40 hours (*hrs_pickup_samp*) and $5.75 (*cost_pickup_samp*). Refer to Section 4.3.2.1.2, activity i) for additional detailed assumptions. The EPA also applied the same inflation percentages to the number of samples to account for the likelihoods a customer would not collect the sample (1 - *pp_hh_return_samp*), the sample is rejected (*pp_samp_reject*), or invalidated (*pp_samp_invalid*).

For NTNCWSs, the EPA uses the same data variable and input for the burden to collect POU sample as a source water sample of 0.5 hours/sample (*hrs_source_op*). Refer to Section 4.3.2.4.2, activity ff) for additional detailed assumptions. The EPA also inflated the number of samples to account for invalidated samples (*pp_samp_invalid*).

CWSs and NTNCWSs must collect tap samples at one-third of the households or taps with POU devices, respectively. See Exhibit 4-99 and Exhibit 4-100 for the estimated number of POU devices for CWSs and NTNCWSs, respectively.

h) ***Determine if samples should be rejected and not analyzed (hrs_samp_reject_op).*** The EPA used the same data variable and input, of 0.25 hours per sample (*hrs_samp_reject_op*), for the CWS's burden to review samples collected by customers to determine if they were collected properly or should be rejected and not submitted for analysis. The EPA also applied the same inflation percentage of 5 percent to the number of samples to account for the likelihood a sample is rejected (*pp_samp_reject*). Refer to Section 4.3.2.1.2 activity f) for additional detail of the likelihood a sample will be rejected and activity j) for the burden to determine if a sample should be rejected.

i) ***Analyze POU tap samples (hrs_analyze_samp_op, cost_lab_lt_samp, cost_commercial_lab).*** Based on input from laboratories, the EPA assumed CWSs serving 3,300 or fewer people and all NTNCWSs will use commercial labs for sample analysis; therefore, these systems will not incur any in-house analytical burden (*hrs_analyze_samp_op*) or cost (*cost_lab_lt_samp*). Instead, these systems will incur a cost of $32.20 per sample (*cost_commercial_lab*) to ship the POU tap sample to the lab ($8.70) and have it analyzed for lead by a commercial lab ($23.50). That cost corresponds to the

same cost input used for systems without LSLs under the lead tap sampling program (*cost_5_commercial_lab*). Refer to Section 4.3.2.1.2, activity k) for additional detail. The EPA also applied the same inflation percentage of 0.6 percent to the number of samples to account for the likelihood a sample is invalidated (*pp_samp_invalid*). Refer to Section 4.3.2.1.2 activity f) for additional detail of the likelihood a sample will be invalidated.

j) ***Prepare and submit sample invalidation request to the State (hrs_samp_invalid_op).*** The EPA used the lead tap sampling data variable and input of 2 hours per request (*hrs_samp_invalid_op*) for the burden for CWSs and NTNCWSs to prepare and submit a sample invalidation request to their State. The EPA assumed that States will approve sample invalidation requests for the 0.6 percent of samples for which systems will submit these requests (*pp_samp_invalid*). Refer to Section 4.3.2.1.2 activity f) for additional detail of the likelihood a sample will be invalidated and activity l) for the burden to request that a sample be invalidated.

k) ***Inform customers of POU tap sample results (hrs_inform_samp_op, cost_cust_lt, hrs_ntncws_inform_samp_op, cost_ntncws_cust_lt).*** The EPA uses the same data variables and inputs for systems to provide the sampling results collected from POU taps as the lead tap sampling program. CWSs must report individual lead sample results to customers who participated in the sampling pool. The EPA estimates that CWSs will require an average of 0.05 hours per customer (*hrs_inform_samp_op*). Systems are also assumed to mail these results at a cost of $0.72 (*cost_cust_lt*). For NTNCWSs, the EPA assumed the systems will deliver materials via email to all customers and post in a public location at a burden of 1 hour for all system sizes (*hrs_ntncws_inform_samp_op*). The EPA assumed NTNCWSs will incur paper and ink costs of $0.079 (*cost_ntncws_cust_lt*) to post the flyer. Refer to Section 4.3.2.1.2, activity m) for additional detailed assumptions regarding these four data variables.

l) ***Certify to the State that POU tap monitoring results were reported to customers (hrs_cert_cust_lt_op).*** For both the lead tap and POU monitoring programs, systems must prepare and submit an annual certification to their State that they informed customers of their monitoring results. For the POU certification, the EPA used the same data variable and input as used for the lead tap sampling program. The EPA assumed a burden of 0.66 hours per year for CWSs and NTNCWSs serving 50,000 or fewer people and 1 hour for those serving more than 50,000 people. Refer to Section 4.3.2.1.2, activity n) for additional detailed assumptions.

m) ***Prepare and submit annual POU program Report to the State (hrs_pou_report_ann_prep_op).*** Systems must prepare and submit a report of their POU program that includes monitoring results, any corrective actions if the AL were exceeded, and if requested by the State, any maintenance activities. The estimated burden and assumptions for CWSs and NTNCWSs are provided in Exhibit 4-105. The EPA assumed systems would submit this report electronically to the State and thus would incur no paper or mailings costs.

Exhibit 4-105: PWS Annual POU Program Report Preparation and Submission Burden

System size (Population Served)	CWSs	NTNCWSs
	hrs_pou_report_ann_prep_op	
	A	B
≤3,300	1	1
3,301-10,000	N/A	2
10,001-50,000	N/A	4
50,001-100,000	N/A	4
100,001-1,000,000	N/A	8
>1,000,000	N/A	

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: “POU Inputs_Final.xlsx.”
Notes:
A, B: Assume reporting and recording keeping is similar to April 2006 EPA guidance on POU/POE devices (USEPA, 2006b).
B: No NTNCWSs serves more than 1 million people. Thus, the burden for this size category is 0.

Exhibit 4-106 provides the SafeWater LCR model cost estimation approach for system ancillary POU system cost inputs including additional cost inputs that are required to calculate these costs.

Exhibit 4-106: PWS Point-of-Use Ancillary Costing Estimation in SafeWater LCR by Activity[1, 2, 3]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
b) Develop POU plan and submit to the State				
The total hours per system multiplied by the system labor rate. *(hrs_pou_plan_dev_op*rate_op)*	Cost applies as written to NTNCWSs.	Above AL	Model PWS selecting POU installation and maintenance as their compliance option	One time
c) Develop public education materials and submit to the State for review				
The total hours per system multiplied by the system labor rate. *(hrs_pe_pou_op*rate_op)*	Cost applies as written to NTNCWSs.	Above AL	Model PWS installing POU device	One time
d) Print POU education material				

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
The hours per household multiplied by the system labor rate and the material cost. *(pws_pop/numb_hh)*((hrs_print_pe_pou_op*rate_op)+cost_print_pe_pou)*	The hours per system multiplied by the system labor rate and the material cost. *((hrs_ntncws_distr_pe_pou_op*rate_op)+cost_ntncws_distr_pe_pou)*	Above AL	Model PWS installing POU device	Once a year
e) Obtain households for POU Monitoring				
One third of households per system multiplied by the hours per sample and the system labor rate. The number of required samples (assumed to be one per household) is inflated to include those unreturned, invalidated, and rejected to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(((1/3)*(pws_pop/numb_hh))+(((1/3)*(pws_pop/numb_hh))*(1-pp_hh_return_samp))+(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid)+(((1/3)*(pws_pop/numb_hh))*pp_samp_reject))*(hrs_samp_volunt_pou_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS installing POU device	Once a year
f) Deliver POU monitoring materials and instructions to participating households[4]				
One third of households per system multiplied by the total of the hours per sample to provide instructions times the system labor rate, plus the cost of materials per sample. The number of required samples (assumed to be one per household) is inflated to include those unreturned, invalidated, and rejected, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((((1/3)*(pws_pop/numb_hh)))+(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid)+(((1/3)*(pws_pop/numb_hh))*(1-pp_hh_return_samp))+(((1/3)*(pws_pop/numb_hh))*pp_samp_reject))*((hrs_discuss_samp_op*rate_op)+cost_pou_samp)*	Cost does not apply to NTNCWSs.	All	Model PWS installing POU device	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
g) Collect tap samples after POU installation				
One third of households per system multiplied by the hours per sample and the system labor rate. The number of required samples (assumed to be one per household) is inflated to include those unreturned, invalidated and rejected to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((((1/3)*(pws_pop/numb_hh)))+(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid)+(((1/3)*(pws_pop/numb_hh))*(1-pp_hh_return_samp))+(((1/3)*(pws_pop/numb_hh))*pp_samp_reject))*((hrs_pickup_samp_op*rate_op)+cost_pickup_samp)*	One third of the number of POU devices per system multiplied by the total of the hours per system times the system labor rate, plus the material cost. The number of required samples is inflated to include those invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *(((1/3)*numb_pou)+(((1/3)*numb_pou)*pp_samp_invalid))*((hrs_source_op*rate_op)+cost_pou_samp)*	All	Model PWS installing POU device	Once a year
h) Determine if samples should be rejected and not analyzed				
One third of households per system with a sample expected to be rejected (calculated by multiplying the total number of required samples by the likelihood of rejection) multiplied by the hours per sample and the system labor rate. *(((1/3)*(pws_pop/numb_hh))*pp_samp_reject)*(hrs_samp_reject_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWS installing POU device	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
i) Analyze POU tap samples[3]				
1/3 of households per system multiplied by the material cost of the commercial lab analysis per sample. All systems installing POUs are assumed to use commercial labs for sample analysis. The number of samples (assumed to be one per HH) is inflated to include those invalidated, to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. *((((1/3)*(pws_pop/numb_hh))+(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid))*cost_commercial_lab)*	1/3 of the number of POU devices per system multiplied by the material cost of the commercial lab analysis per sample. All systems installing POUs are assumed to use commercial labs for sample analysis. The number of required samples is inflated to include those invalidated to ensure that the cost reflects the additional burden that must occur to meet the sampling requirement. Systems will collect one sample per POU device. *(((1/3)*numb_pou)+(((1/3)*numb_pou)*pp_samp_invalid))*cost_commercial_lab*	All	Model PWS installing POU device	Once a year
j) Prepare and submit sample invalidation request to the State				
1/3 of HHs per system where a sample is expected to be invalid (calculated by multiplying the total number of required samples by the likelihood of invalidation) multiplied by the hours per sample and the system labor rate. *(((1/3)*(pws_pop/numb_hh))*pp_samp_invalid)*(hrs_samp_invalid_op*rate_op)*	1/3 of the number of POU devices per system where a sample is expected to be invalid (calculated by multiplying the total number of required samples by the likelihood of invalidation) multiplied by the hours per sample and the system labor rate. *((1/3)*numb_pou)*pp_samp_invalid)*(hrs_samp_invalid_op*rate_op)*	All	Model PWS installing POU device	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range[2]	Other Conditions	
k) Inform customers of POU tap sample results				
1/3 of HHs per system multiplied by the total of the hours per sample times the system labor rate plus the material cost per sample. *((1/3)*(pws_pop/numb_hh))*((hrs_inform_samp_op*rate_op)+cost_cust_lt)*	The hours per system multiplied by the system labor rate, plus the material cost. *(hrs_ntncws_inform_samp_op*rate_op)+ cost_ntncws_cust_lt*	All	Model PWS installing POU device	Once a year
l) Certify to State that POU tap sample results were reported to customers				
The total hours per system to submit certification multiplied by the system labor rate. *(hrs_cert_cust_lt_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS installing POU device	Once a year
m) Prepare and submit annual POU program report to the State				
The total hours reporting cost per system multiplied by the system labor rate. *(hrs_pou_report_ann_prep_op*rate_op)*	Cost applies as written to NTNCWSs.	All	Model PWS installing POU device	Once a year

Acronyms: AL = action level; CWS = community water system; HH = household; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.

Notes:

[1] The data variables in this exhibit are defined previously in this section with the exception of:

- *numb_pou*: Number of POU devices per PWSs that elects POU option (Section 4.3.5.1).
- *pp_commercial_samp*: Likelihood a sample will be analyzed by a commercial laboratory (Section 4.3.2.1.2, activity k)).
- *pp_lab_samp*: Likelihood a sample will be analyzed in-house (Section 4.3.2.1.2, activity k)).
- *rate_op*: PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] Once the POU program is started in response to a lead ALE, systems must continue to implement this program regardless of their subsequent lead 90th percentile levels.

[3] For CWSs, the number of POU devices equals the number of households.

[4] The burden and costs to provide sample bottles (*cost_pou_samp*) under activity f) and conduct analyses under activity i) are incurred by the State in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina (ASDWA, 2020a).

4.3.5.3 Estimate of PWS National Point-of-Use Device Installation and Maintenance Costs

As shown in Exhibit 4-1, the estimated incremental annual costs of POU device installation and maintenance range from $2.7 million to $3.7 at a 2 percent discount rate in 2022 dollars.

4.3.6 PWS Lead Public Education, Outreach, and Notification Costs

Systems will incur labor and non-labor costs to provide consumer notice related to individual lead and copper tap results, to conduct education and outreach regardless of their lead 90th percentile level, and to conduct public education requirements in response to a lead 90th percentile level exceedance. These activities and associated costs are detailed in Sections 4.3.6.1 through 4.3.6.3, respectively. Systems with multiple lead ALEs will be required to conduct additional public education activities. These activities and associated costs are detailed in Section 4.3.6.4. Exhibit 4-119 provides the SafeWater LCR model cost estimation approach for system lead public education and outreach costs for Sections 4.3.6.1 and 4.3.6.2 and is located at the end of Section 4.3.6.2. Similar exhibits for Sections 4.3.6.3 and 4.3.6.4 are provided at the end of each section as Exhibit 4-126 and Exhibit 4-132, respectively. Section 4.3.6.5 provides the national annualized lead public education and outreach costs at a 2 percent discount rate.

Public education requirements for systems implementing a POU program were previously discussed in Section 4.3.5.2 in activities d), e), and f).

4.3.6.1 Consumer Notice

Under the final LCRI, water systems must notify consumers of their individual lead and/or copper results within three business days of learning the results, regardless if they above or below the AL. The EPA assumed CWSs would use mail and NTNCWSs would use posting and electronic notification. For CWSs, the EPA included the burden of 0.05 to 0.11 hrs and cost of $0.72 per notification as part of the Lead Tap Sampling Costs using *hrs_inform_samp_op* and *cost_cust_lt*, respectively. Similarly, the EPA used the burden of 1 hour and cost of $0.79 per monitoring period as part of the Lead Tap Sampling Costs using *NTNCWS_inform_samp_op* and *cost_NTNCWS_inform_lt* for NTNCWSs.

Exhibit 4-107 provides the unit burden and/or cost for the CWS and NTNCWSs to submit a copy of the consumer notification and a certification that the notification was distributed in a manner that meets the rule requirements to their State. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-107: PWS Burden for Consumer Notification of Lead and Copper Tap Sampling Results

Activity		Unit Burden and/or Cost	*SafeWater LCR Data Variable*
a)	Develop lead consumer notice materials and submit to the State for review (one time)	7 hours/PWS	*hrs_consumer_notice_devel_op*
b)	Provide a copy of the consumer notice and certification to the State	0.08 hrs/customer contact	*hrs_samp_notice_op*

Source: “Public Education Inputs_CWS_Final.xlsx” and “Public Education Inputs_NTNCWS_Final.xlsx.”

a) ***Develop lead consumer notice materials and submit to the State for review (hrs_consumer_notice_devel_op).*** The EPA assumed that States will provide templates to CWSs and

NTNCWSs to develop consumer notice materials to include individual lead and copper tap results, an explanation of the health effects of lead and copper, a list of steps consumers can take to reduce exposure to lead and copper in drinking water, the maximum contaminant level goal and the AL for lead and copper and the definitions for these two terms. The EPA also assumed that systems will incur a burden of 7 hours to develop the lead consumer notice and submit it to their State for review. The burden estimate is based on the hours to prepare additional brochure language from Exhibit 33a of the 2022 Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal) (USEPA, 2022a).

b) ***Provide a copy of the consumer notice to the State (hrs_samp_notice_op).*** CWSs and NTNCWSs must submit a copy of the consumer notification and a certification that the notification was distributed in a manner that meets the rule requirements to their State. The EPA assumed systems would require 5 minutes or 0.083 hours to submit an electronic copy ($0) of this notice and certification to the State (*hrs_samp_notice_op*).

4.3.6.2 Activities Regardless of Lead 90th Percentile Level

The EPA has developed CWS costs for activities associated with new public education requirements under the final LCRI that are independent of a system's lead 90th percentile range, as provided in Exhibit 4-108. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden and/or cost follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Note that the final LCRI would require enhanced outreach for water systems that do not meet their SLR rate (see Section 4.3.4.3). However, the burden and cost associated with this outreach is not included in the cost model because the EPA assumes full compliance with the regulation.

Exhibit 4-108: PWS Burden and Cost for Public Education Activities that Are Independent of Lead 90th Percentile Levels

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
c) Update CCR language (one-time)	0.5 hrs/CWS serving ≤3,300 people; 1 hr/CWS serving > 3,300 people	*hrs_update_ccr_op*
d) Develop new customer outreach plan (one-time)	4 hrs/CWS with LSL or GRR SLs serving ≤50,000 people; 8 hr/CWS with LSLs or GRR SLs serving > 50,000 people	*hrs_cust_plan_op*
e) Develop approach for improved public access to lead health-related information and tap sample results (one-time)	10 to 40 hours/CWS	*hrs_pub_access_op*
f) Establish a process for public access to information on known or potential lead	5 hrs/CWS with lead content SLs serving ≤3,300 people; 10 hrs/CWS with lead content SLs serving > 3,300 people	*hrs_access_lsl_op*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
content SL locations and tap sample results (one-time)		
g) Maintain a process for public access to lead health information, known or potential lead content SL locations, and tap sample results	No LSLs 2 hrs/CWS serving ≤ 3,300 people 4 hrs/CWS serving > 3,300 people With LSLs 6 hrs/CWS serving ≤ 3,300 people 12 hrs/CWS serving > 3,300 people	*hrs_maint_lsl_op*
h) Respond to customer request for known or potential lead content SL information	0.05 hrs/request; $0/request	*hrs_hh_request_op;* *cost_hh_request*
i) Respond to requests from realtors, home inspectors, and potential home buyers for known or potential lead content SL information	0.05 hrs/request; $0/request	*hrs_other_request_op;* *cost_other_request*
j) Develop a list of local and State health agencies	CWSs 0.08 hrs/ local and State health	*hrs_hc_list_op*
k) Develop lead outreach materials for local and State health agencies and submit to the State for review (one-time)	7 hrs/CWS	*hrs_pub_devel_hc_op*
l) Deliver lead outreach materials for local and State health agencies	CWSs 24 to 208 hrs/local and State health agency; $71.65/ local and State health	*hrs_hc_op;* *cost_hc*
m) Develop public education for known or potential lead content SL disturbances and submit to the State (one-time)	7 hrs/CWS with LSLs	*hrs_pub_devel_wtr_op*
n) Deliver public education for SL disturbances	0.083 hours/delivery; $0.21/delivery	*hrs_pub_deliv_wtr_op;* *cost_pub_deliv_wtr_ed*
o) Deliver filters and 6 months of replacement cartridges during SL disturbances	$64.00/household	*cost_filter_hh*
p) Develop inventory-related outreach materials and submit to the State for review (one time)	7 hours per system	*hrs_pe_lsl_gen_develop_op*
q) Distribute inventory-related outreach materials	CWS 0.4426 to 0.0026/household per year $0.35 to $0.48/household per year NTNCWS 1 hr per system per year $0.79 per system per year	CWS *hrs_pe_lsl_gen_dist_op* *cost_pe_lsl_gen* NTNCWS *hrs_ntncws_pe_lsl_gen_dist_op* *cost_ntncws_pe_lsl_op*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
r) Provide translation services for public education materials	1.5 to 3.38 hrs/CWS per year $200 to $800/CWS per year	*hrs_translate_phone_op; cost_translate_cws*
s) Certify to the State that lead outreach was completed	CWSs 2 hrs/CWS serving ≤50,000 people; 3 hrs/CWS serving > 50,000 people NTNCWSs 0.66 hrs/NTNCWS serving ≤50,000 people; 1 hr/NTNCWS serving > 50,000 people	CWSs *hrs_pe_certify_quarterly_op* NTNCWSs *hrs_cert_outreach_annual_op*

Acronyms: CCR = consumer confidence report; CWS = community water system; GRR = galvanized requiring replacement; LSL = lead service lines; NTNCWS = non-transient non-community water system; SL = service line.
Sources:
c) - n): "Public Education Inputs_CWS_Final.xlsx."
o): Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water (USEPA, 2023b).
p -s): "Public Education Inputs_CWS_Final.xlsx;" "Public Education Inputs_NTNCWS_Final.xlsx."

c) ***Update Consumer Confidence Report (CCR) language (hrs_update_ccr_op).*** The EPA is requiring CWSs to update information about lead in the CCR. CWSs will incur a one-time burden (*hrs_update_ccr_op*) to update their CCR with the revised lead health effects language and for systems with LSLs and/or GRR service lines to further update their materials to include information about a system's SLR program and opportunities to replace lead and GRR service lines. Systems with lead and GRR service lines must also include information on how to access the service line inventory and how to access the results of all tap sampling in the CCR. The EPA assumed for:

- CWSs serving 3,300 or fewer, 50 percent will use CCRiWriter[133] or a similar program to update their CCR and will incur no additional burden because the standard text will already be in the program. This percentage is based on current CCRiWriter users who are generally small systems. All other CWSs serving 3,300 or fewer are assumed to incur 1 hour, giving an average burden of 0.5 hours across all systems in this size category.
- CWSs serving more than 3,300 people will not use CCRiWriter and will incur a burden of 1 hour.

d) ***Develop new customer outreach plan (hrs_cust_plan_op).*** In response to final LCRI requirements, CWSs with lead and GRR service lines will develop a new customer outreach plan. The EPA estimated that systems serving 50,000 or fewer people will incur 4 hours of burden and those systems serving more than 50,000 people will take 8 hours to develop the plan.

e) ***Develop approach for improved public access to lead health-related information and tap sample results (hrs_pub_access_op).*** CWSs will incur a one-time burden to develop improved public access to lead data that includes lead health-related data and tap monitoring results. The EPA assumed that systems serving 3,300 or fewer people with no existing system website will make data available

[133] The CCRiWriter is a web-based program that allows water systems to enter data and generate their annual CCR.

for the public in hard copy form at the system office. Systems serving more than 3,300 will update their existing websites. The one-time burden estimates are included in Exhibit 4-109.

Exhibit 4-109: One-Time Burden (per CWS) to Develop Approach for Improved Access to Lead Information

System Size (Population Served)	Hours to Develop Approach for Improved Public Access to Lead Data (all CWSs)
	hrs_pub_access_op
≤3,300	10
3,301-10,000	20
10,001-50,000	25
50,001-100,000	30
100,001-1,000,000	35
>1,000,000	40

Acronyms: CWS = community water system.
Source: "Public Education Inputs_CWS_Final.xlsx," worksheet, "Public Access."

f) ***Establish a process for public access to information on known or potential lead content SL locations (hrs_access_lsl_op).*** Under the final LCRI, CWSs must establish a way for customers and the public to access information on potential lead content SLs. The EPA assumed that this will be a one-time burden that applies to all CWSs with potential lead content SLs regardless of lead 90th percentile level. The EPA assumed systems serving 3,300 or fewer with no existing system website will make the information available in hard copy form at the system office and incur 5 hours to print materials and set up a viewing location. The EPA assumed systems serving more than 3,300 people will provide access to information about lead line locations and the replacement program by adding content to an already existing website with links to materials and incur a burden of 10 hours per system. Note that the hours associated with determining locations of potential lead content SLs and establishing a replacement outreach program are described in Section 4.3.4.1.

g) ***Maintain a process for public access to health information, known or potential lead content SL locations, and tap sample results (hrs_maint_lsl_op).*** CWSs with potential lead content SLs would also incur an annual burden to maintain a way for the public to access lead health and potential lead content SL information. The EPA assumed that:

- CWSs serving 3,300 or fewer people have no existing system website. Those without lead or GRR service lines will require 2 hours to maintain lead-related data, such as lead sample results in hard copy files. Those systems with lead or GRR service lines take an additional 4 hours to provide updated potential lead content SL locational information for a total annual burden of 6 hours.

- CWSs serving more than 3,300 people without lead or GRR service lines will require 4 hours to update their website annually with lead-related data. Those with lead or GRR service lines will require a total of 12 hours to update their website with health information, new potential lead content SL locational information, and tap sample results.

h) ***Respond to customer requests for known or potential lead content SL information (hrs_hh_request_op, cost_hh_request).*** CWSs will incur a per household burden to respond to potential lead content SL information requests from homeowners and residents (*hrs_hh_request_op*). The EPA assumed CWSs with potential lead content SLs will respond by phone and spend an average of 3 minutes (0.05 hours) per request. The EPA assumed systems without potential lead content SLs may still get inquiries, but the burden to be negligible. The EPA assumed systems will not provide printed materials in response to these inquiries. Therefore, the cost to respond to request from households (*cost_hh_request)* is $0.

The EPA estimated the likelihood that that a particular household in a system with potential lead content SLs will request information about potential lead content SLs to be 0.0032 each year (*pp_hh_request_lslr*). This was computed as a weighted average over the 32-year period from Year 4 through Year 35 of the analysis, as shown in Exhibit 4-110. Underlying this estimate are the assumptions that these requests would come from 10 percent of households having young children (under six years of age) present in each year in those systems having potential lead content SLs. As shown in Exhibit 4-110, the EPA estimated that in Year 4, the likelihood that a household already has children under the age of six is 0.11 (Column C, based on Columns A and B). The EPA also estimated that the likelihood a new child will be born at a household each year for Years 5 through 35 is 0.0294 (Column E, based on Columns D and A). Column F (using the results in Columns C and E) shows the calculation of the weighted average likelihood of a child under six being present in a given household in each of the 32 years of the period of analysis. Lastly, Column G applies the assumption that only 10 percent of those households will request LSL information.

Exhibit 4-110: Likelihood that a Resident Will Request Information about potential lead content SLs

Total Households in the United States	Households with Children under Six Years Old	Likelihood a Household Has Children under Six Years Old in Year 4	Births per year in 2020	Likelihood of a Birth per Household per Year in Years 5 to 35	32-Year Weighted Average Likelihood a Household has Children under Six Years Old Each Year	Likelihood that a Household Having Children under Six Will Request Potential Lead Content SL Information Each Year
A	B	C = (B/A)	D	E = (D/A)	F = (C+(31*E))/32	G = F*0.1 *pp_hh_request_lslr*
122,802,852	13,512,226	0.11	3,613,647	0.0294	0.03195	0.0032

Acronyms: SL = service line.
Sources:
A-D: Information is also documented in Public Education Inputs_CWS_Final.xlsx.
A-C: U.S. Census Bureau, 2019 American Community Survey 1-Year Estimates (https://data.census.gov/cedsci/table?q=households%20and%20families&tid=ACSST1Y2019.S1101).
D: CDC. 2019. https://www.cdc.gov/nchs/nvss/births.htm. Accessed January 7, 2022.

i) ***Respond to requests from realtors, home inspectors, and potential home buyers for known or potential lead content SL information (hrs_other_request_op, cost_other_request).*** CWSs with potential lead content SLs must also respond to requests for potential lead content SL information from other parties (*e.g.*, realtors, home inspectors, and potential homebuyers). The EPA assumed the same burden of 0.05 hours to respond to these requests by phone as assumed for responding to a request from a homeowner (*hrs_other_request_op*). The EPA assumed systems without potential lead content SLs may still get inquiries, but that the burden will be negligible. The EPA assumed systems will not provide printed materials in response to these inquiries. Therefore, the material cost to respond to other potential lead content SL information requests (*cost_other_request)* is $0.

The EPA conducted the following steps to determine the estimated number of requests that systems will receive each year from other parties (*numb_other_request*).

1. Determined the percentage of households with children under the age of 6 that moved using United States Census Bureau data from 2020, as shown in Exhibit 4-111.

Exhibit 4-111: Households (HHs) with Children under 6 and That Moved

Total number of HHs	Total number of HHs that moved	Total HHs with any children under 6	Total HHs with any children under 6 that moved	Percent of all HHs that moved	Percent of HHs with any children under 6 that moved
A	**B**	**C**	**D**	**E = (B/A)*100%**	**F = (D/A)*100%**
48,493	5,019	14,080	1,873	10.35%	3.86%

Source: U.S. Census Bureau, Current Population Survey, 2020 Annual Social and Economic Supplement. https://www.census.gov/data/tables/2020/demo/geographic-mobility/cps-2020.html

2. Multiplied the percentage of households with children under the age of 6 that moved by the number of households per system. The EPA assumed that other parties would request LSL information on 10 percent of the resulting number of households. The resulting number of requests (*numb_other_request*) is provided in Exhibit 4-112.

Exhibit 4-112: Number of Potential Lead Content SL Information Requests from Realtors, Home Inspectors, and Potential Home Buyers

System Size (Population Served)	Number of CWSs	Total Population Served	Average Population per CWS	Average Households per CWS	Number of requests per CWS
			C = B/A	**D=C/2.53**	**E=D*3.86%*10%**
	A	**B**	*pws_pop*		*numb_other_request*
≤100	11,732	708,236	60	24	0
101-500	15,084	3,830,126	254	100	0
501-1,000	5,330	3,931,488	738	292	1
1,001-3,300	7,967	15,218,647	1,910	755	3

System Size (Population Served)	Number of CWSs	Total Population Served	Average Population per CWS	Average Households per CWS	Number of requests per CWS
			C = B/A	D=C/2.53	E=D*3.86%*10%
	A	B	*pws_pop*		*numb_other_request*
3,301-10,000	5,026	29,565,710	5,883	2,325	9
10,001-50,000	3,374	74,162,674	21,981	8,688	34
50,001-100,000	571	39,629,417	69,404	27,432	106
100,001-1,000,000	421	99,359,362	236,008	93,284	360
>1,000,000	24	46,638,891	1,943,287	768,098	2,967

Acronyms: CWS = community water system.
Notes:
A, B: SDWIS/Fed, current through December 31, 2020 with an adjustment to systems serving ≤100. The EPA increased the population to 25 for those systems reported in SDWIS/Fed as serving < 24 people. This resulted in an increase in population from 701,258 to 708,236 for this size category.
D: Estimated as 2.53 people per household *(numb_hh)* for the year 2020 (U.S. Census Bureau, 2020). Table AVG1. Average Number of People per Household, by Race and Hispanic Origin, Marital Status, Age, and Education of Householder: 2020. https://www2.census.gov/programs-surveys/demo/tables/families/2020/cps-2020/tabavg1.xls.
E: Assumes of the households with children ages 6 and under that moved, *i.e.*, 3.86 percent (see Column F, Exhibit 4-111), 10 percent would request information.

j) Develop list of local and State health agencies (hrs_hc_list_op). All CWSs must conduct annual outreach to State and local health agencies to discuss the sources of lead in drinking water, health effects of lead, steps to reduce exposure to lead in drinking water, and information on DSSA activities. The EPA expects CWSs will work with their State to conduct increased lead outreach to health agencies. Systems will incur a one-time upfront burden to develop an initial list of local and State health departments in their service area. The EPA assumed systems would require 5 minutes for each health agency or 0.08 hours per agency, which is the same burden the EPA used to estimate the burden to develop an initial contact list of schools and child care facilities for the lead in drinking water testing program (*hrs_school_identify_op*) in activity ii) of Section 4.3.2.5.1. The burden per health agency is multiplied by the number of health agencies (*numb_ha +1*), shown in Exhibit 4-113, to develop the unit cost.

Exhibit 4-113: Estimated Number of Health Agencies

System Size (Population served)	# of Organizations per system
	numb_ha +1
≤100,000	2
100,001 – 1,000,000	3
>1,000,000	17

Source: "Public Education Inputs_CWS_Final.xlsx," worksheet, "Outreach to Health Depts." EPA assumed each system would contact one additional State health agency.

k) ***Develop lead outreach materials for local and State health agencies and submit to the State for review (hrs_pub_devel_hc_op).*** All CWSs are assumed to incur burden to develop lead outreach materials for State review that will be distributed to local and State health agencies. The EPA assumed systems will incur a burden of 7 hours, which is based on the hours to prepare additional brochure language from Exhibit 33a of the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (USEPA, 2022a).

l) ***Deliver lead outreach to local and State health agencies (hrs_hc_op, cost_hc).*** CWSs must provide the results of school testing to local and State health care agencies within 30 days of receiving the results. The EPA assumed that a portion of schools and child care facilities will be tested each month and therefore would report the results monthly. In addition, once a year the information to the local and State health department would include the outreach materials developed under activity k), as well as the results of any DSSA activities in response to a sample above 10 µg/L (as previously discussed in Section 4.3.2.5 and Section 4.3.3.3.3, respectively). Systems will also incur annual burden to make any necessary updates to the list of organizations. The resulting monthly burden estimates for conducting outreach to health care agencies are provided in Exhibit 4-114.

Exhibit 4-114: Annual CWS Burden (per system) to Conduct Outreach to Local and State Health Agencies

System Size (Population served)	# of Organizations per system	Production Time per organization	Distribute Letters per month	Update List of Organizations (annual)	Total (Annual Burden)
	A	**B**	**C = A*B**	**D**	**E = (C*12)+D**
	numb_ha + 1				*hrs_hc_op*
≤3,300	2	1	2	0	24
3,301-100,000	2	1	2	1	25
100,001-1,000,000	3	1	3	2	38
>1,000,000	17	2	34	2	410

Notes
A: See Exhibit 4-113.
B: The EPA assumed systems would require 1 hour and 2 hours each month to prepare a cover letter and assemble the results of lead in drinking water testing at schools and child care facilities for systems serving 1 million people or fewer and more than 1 million people, respectively. In addition, once per year, the information to local and State health departments will also include DSSA.
D: The EPA assumed zero burden for systems serving 3,300 or fewer people. For CWSs serving 3,301 to 100,000 people, the EPA assumed an annual burden of 1 hour per system to update the list of organizations. For systems serving more than 100,000 people, the EPA assumed an annual burden of 2 hours per system.

The EPA assumed systems will deliver the information to State and local health departments via certified mail each month at an estimated cost of $5.97 per organization (*cost_hc*) per month that includes paper

($0.019), envelope ($0.092), ink ($0.06), and certified mail ($5.80) for a total annual cost of $71.65 per health agency.

m) ***Develop public education materials for known or potential SL disturbances and submit to the State (hrs_pub_devel_wtr_op).*** CWSs with lead, GRR, and unknown service lines must send public education to customers and consumers when there is scheduled water-related work that could result in disturbances of service lines and will incur a one-time burden to develop materials. The EPA assumed:

- All CWSs with lead, GRR, and unknown service lines will develop these materials.
- The development of public education materials is similar across all types of public education because systems will use EPA-developed templates and incur a burden of 7 hours, which is based on the hours to prepare additional brochure language from Exhibit 33a of the 2022 Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal) (USEPA, 2022a).

Under the final LCRI, outreach is also required due to disturbances to lead, GRR, or unknown service lines during inventorying. The EPA assumed disturbances will occur when a system conducts mechanical or vacuum excavation during the inventory process. Outreach activities are assumed to include a door hanger and filter. These costs are captured in Section 4.3.4.1.2.

n) ***Deliver public education materials for SL disturbances (hrs_pub_deliv_wtr_op, cost_pub_deliv_wtr_ed).*** CWSs that cause disturbances to a lead, GRR, or lead status unknown service line will also incur an annual burden to deliver public education to impacted households about the potential for elevated lead levels in drinking water as a result of the disturbance. The annual burden to deliver public education (*hrs_pub_deliv_wtr_op*) is assumed to be 5 minutes per delivery (0.083 hours). Systems are assumed to provide the messaging on door hangers that they will distribute when they are in the area conducting work. The average cost of doorhangers is $0.21 based on quotes from three vendors (*cost_pub_deliv_wtr_ed*). See "Public Education Inputs_CWS_Final.xlsx," worksheet "Service Line Disturbances" for specific quotes.

In Section 4.3.4.1.2, the EPA estimated the frequency of events that would result in exposed service lines during normal operation (this input was used to estimate the proportion of unknowns in the inventory that would be identified each year during normal operation). These events included meter replacement (6 percent per year), water main replacement[134] (1 percent per year), and other activities including water meter reading, service line repair or replacement, backflow prevention inspection, and other street repair or capital improvement projects (0.5 percent per year). As a simplifying assumption, the EPA used the same total of ***7.5 percent per year*** to estimate the percent of lead, GRR, and unknown service lines that are disturbed each year and require delivery of public

[134] In the final LCRI, the EPA specified that water systems must provide a filter (and 6 months of replacement cartridges) and public education material not only if disturbance results from replacement of an inline water meter, a water meter setter, or connector, but also if disturbance results from replacement of water main. The EPA increased the estimate frequency of events that would result in a disturbance to reflect this rule change.

education material (*perc_hh_water_wrk*)[135]. This may be an overestimate because some activities such as backflow prevention inspection and meter reading may not result in a disturbance.

o) ***Deliver filters and 6 months of replacement cartridges during SL disturbances (cost_filter_hh).*** Similar to activity n) above, CWSs are required to provide filters and replacement cartridges whenever there is a physical disturbance of a lead, GRR, or lead status unknown service line that involves replacement of a meter, gooseneck, pigtail, or other connector. They also must be provided when a physical disturbance results from the replacement of a water main whereby the service line pipe is physically cut . As discussed in activity n), the EPA assumes the likelihood of these disturbances to be 7.5 percent (*perc_hh_water_wrk*). The EPA assumed that the pitchers and filters delivered to each resident to use for six months following a replacement will cost $64 on average (including shipping and filter replacement). See *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b) for additional detail.

The EPA assumes that the pitchers and POU filters delivered to each resident to use for six months following SLR will cost $64 on average (including shipping and filter replacement). See *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b) for additional detail.

p) ***Develop inventory-related outreach materials and submit to the State for review (hrs_pe_lsl_gen_develop_op).*** Under the final LCRI, CWSs and NTNCWSs must provide notification to consumers served by lead, GRR, or service lines of unknown material. The notification includes information on the health effects and sources of lead in drinking water (including LSLs), how to access the SLR plan, how to have water tested for lead, actions consumers can take to reduce exposure to lead, and information about the opportunities for SLR. In addition, the materials must include instructions for consumers to notify the water system if they think the material categorization is incorrect. CWSs and NTNCWSs will incur a one-time burden to develop these outreach materials. The EPA assumed that systems will use EPA-developed templates as a starting point for the notice but will adjust the template as needed to fit with specific system characteristics resulting in an average burden of 7 hours per system. The 7 hour estimate comes from Exhibit 33a of the 2022 Disinfectants/Disinfection Byproducts, Chemical and Radionuclides ICR (Renewal) (USEPA, 2022a).

q) ***Distribute inventory-related outreach materials (hrs_pe_lsl_gen_dist_op; cost_pe_lsl_gen; hrs_ntncws_pe_lsl_gen_dist_op; cost_ntncws_pe_lsl.*** CWSs will incur an annual cost to distribute outreach materials to households served by lead, GRR, or unknown service lines. The EPA assumes systems will use a combination of separate mailings and inserts that are part of the water bill (each 50 percent). The burden for CWSs to annually distribute these materials is provided in Exhibit 4-115.

The per household cost to distribute the materials in the water bill is $0.16 (cover letter: paper = $0.019 + ink = $0.06; brochure: $0.019 + ink = $0.06). The per household mailing cost for systems serving 500 or fewer people of $0.80 includes the material cost of $0.16 plus an envelope of $0.092

[135] For the proposed LCRI EA, the EPA assumed that 5.9 percent of households will be impacted annually by water-related work disturbances and would receive public education based on the estimated life of a water main, meter, and other SLRs provided by Massachusetts Water Resources Authority. Utilizing these data, the EPA previously assumed an average 17-year life of a meter, CWSs would replace a meter at an annual rate of 5.9 percent.

and \$0.55 postage. The per household mailing cost for systems serving more than 500 people of \$0.55 includes the material cost of \$0.16 plus an envelope of \$0.092 and bulk rate postage of \$0.299. The EPA averaged the two methods for an estimated per household delivery cost of \$0.48 and \$0.35 for systems serving 500 or fewer people and more than 500 people, respectively. See "General Cost Model Inputs_Final.xlsx" for additional information about paper, ink, envelope, and postage costs.

Exhibit 4-115: CWS Annual Burden (per household) to Distribute General Inventory-related Outreach

System Size (Population Served)	Separate mailing per System	Bill Stuffer per System	Subtotal per System	Production (hrs per HH)	Number of HH per system	Separate/Bill Stuffer (hrs per HH)	Total (hrs per HH) *hrs_pe_lsl_gen_dist_op*
	A	B	C = (A+B)/2	D	E	F = C / E	G = D + F
≤100	15	6	10.5	0.0025	24	0.4401	0.4426
101-500	15	6	10.5	0.0025	100	0.1046	0.1071
501-1,000	25	10	17.5	0.0025	292	0.0600	0.0625
1,001-3,300	25	10	17.5	0.0025	755	0.0232	0.0257
3,301-10,000	120	30	75	0.0025	2,325	0.0323	0.0348
10,001-50,000	120	30	75	0.0025	8,688	0.0086	0.0111
50,001-100,000	120	30	75	0.0025	27,432	0.0027	0.0052
100,001-1,000000	120	30	75	0.0025	93,284	0.0008	0.0033
>1,000,000	120	30	75	0.0025	768,098	0.0001	0.0026

Source: "Public Education Inputs_CWS_Final.xlsx," worksheet, "Targeted Outreach."

Note:

A: The EPA assumption regarding the burden per system to conduct separate mailings.

B: The EPA assumption regarding the burden per system to mail materials with the water bill.

C: The EPA assumes that half of systems will conduct separate mailings and the other half will include targeted outreach materials with the water bill.

D: The EPA assumes 0.25 hours per 100 brochures for production. Estimate is based on assumptions for production labor used in the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule (Exhibit 17).

E: "Public Education Inputs_CWS_Final.xlsx," worksheet, "Number of Households."

For NTNCWSs, the EPA assumed these systems will provide outreach via e-mail and public posting. The EPA assumed a burden of 0.5 hour to develop/send e-mail for all system size categories and an additional 0.5 hours to post the notification publicly for a total annual burden of 1 hour per system. The EPA assumed that NTNCWSs will provide electronic notification and posting. Material costs of $0.79 per system are for paper ($0.019) and ink ($0.06). See file, "General Cost Model Inputs_Final.xlsx", worksheet "Paper_Envelopes" and worksheet, "Ink" for paper and ink based on costs from three vendors, respectively.

r) ***Provide translation services for public education materials (hrs_translate_phone_op, cost_translate_CWS)[136].*** Under the final LCRI, water systems serving a large proportion of consumers with limited English proficiency, as determined by the State, must include in all public education materials listed under 40 CFR 141.85 information in the appropriate language(s) regarding the importance of the materials. These systems must also either: 1) include contact information for persons served by the water system to obtain a translated copy of or translation assistance with the public education materials, or 2) pre-emptively provide the public education materials in the appropriate language(s). In addition, the final LCRI requires, as a condition of primacy, that States provide technical assistance to water systems in meeting the requirement to provide translation assistance in communities with a large proportion of consumers with limited English proficiency.

   The EPA's approach for developing unit costs is to estimate phone and written translation labor and non-labor costs for subsets of PWSs that must conduct public education under the final LCRI. Note that the pre-2021 LCR and 2021 LCRR also required translation support in the case of a lead ALE. The EPA did not estimate translation costs for the pre-LCR and 2021 LCRR, which underestimates baseline costs, resulting in an overestimate of incremental translation costs from both the pre-2021 LCR and 2021 LCRR baselines to the final LCRI. Throughout this analysis, the EPA relied on data and assumptions related to the translation component of the CCR Revisions rulemaking, which are presented in the document, *Analysis of the Economic Impacts of the Final Consumer Confidence Reports Rule Revisions* (USEPA, 2024a), hereafter referred to as the "Final CCR3 EA."

   As the first step of this analysis, the EPA estimated the likelihood that the water systems serve a large proportion of non-English speaking customers and require translation under the LCRI. The EPA used a simplifying assumption that no NTNCWSs serve a large proportion of non-English speaking customers because NTNCWSs are often businesses such as schools, factories, office buildings, and hospitals and the organization would already have staff available to provide translation services for employees if needed. For CWSs, the EPA assumed that they will provide translation services if a system meets at least one of the following criteria: 1) at least 5 percent of the system's total population served, or 2) at least 1,000 people served, have limited English proficiency. This criterion is based on assumptions developed in the Final CCR3 EA (USEPA, 2024a). The Final CCR3 EA estimated the number of CWSs that would meet this threshold using

[136] The EPA updated the estimates for translation between the proposed and final LCRI to reflect changes in the proposed and Final CCR3 EA. In particular, changes reflect new information gathered through a review of 120 system websites and CCRs. Revisions to this analysis also reflect the final LCRI requirement that States must provide translation if requested by the system as a condition of primacy.

data from the American Community Survey (ACS) 2016-2020 5-Year Estimates, which provided the population of metropolitan areas with limited English proficiency (U.S. Census Bureau, 2022). The EPA utilized this same dataset but disaggregated the percentages into nine system size categories for the LCRI instead of the four system size categories used in the Final CCR3 EA. The percentages ranged from 7 percent of small systems serving 100 or fewer people to 100 percent for large systems serving more than 100,000 people. These percentages are provided in Exhibit 4-116 and represent the likelihood that any translation assistance will be needed (*p_translation*). Note that many States have not set a limited English proficiency threshold***.*** If the State sets a higher threshold, fewer systems would need to provide translation services. Thus, assuming a 5 percent/1,000 person threshold for each State may be conservative and overestimate the percent of systems needing to provide translation services.

Exhibit 4-116: Likelihood that the CWS Has a High Proportion of non-English Speaking Customers

System Size (Population Served)	***SafeWater LCR Variable*** *p_translation*
≤100	7%
101-500	11%
501-1,000	14%
1,001-3,300	18%
3,301-10,000	28%
10,001-50,000	50%
50,001-100,000	94%
100,001-1,000,000	99%
>1,000,000	100%

The EPA then estimated the likelihood of CWSs that will use phone support instead of written translations (*p_translation_phone*). This likelihood is based on recent research conducted for the Final CCR3 EA whereby the EPA randomly selected 120 CWSs and reviewed both their websites and most recent CCRs to investigate what methods (if any) these systems already employ to provide meaningful access to consumers with limited English proficiency. From this research, the Final CCR3 EA reported that among systems that already provide translation, an estimated 70 percent of systems serving more than 100,000 people provided a translated report. For systems serving 100,000 or fewer people, a majority, estimated also at 70 percent, included a contact number for translation assistance. The EPA used the same estimates for the Final LCRI EA.

With respect to whether the CWSs or States will be providing translation services, the EPA made a simplifying assumption that small systems serving 10,000 or fewer people will rely on the State, whereas systems serving more than 10,000 will provide their own translations based on the analysis of 120 CCRs as described above. The EPA used the same assumption for phone translation (*p_translation_phone_cws*) and written translation (*p_translation_written_cws*). Note that the Final CCR3 EA used a more detailed analysis of each State's support; however, the

EPA expects translation support for LCRI to be more consistent across States given it is a condition of primacy and therefore national level estimates are used in this cost analysis.

The final step in the analysis is to estimate unit labor and non-labor for each type of public education required under 40 CFR 141.85 for phone and written translation. For the purposes of modeling translation costs using the SafeWater LCR model, the EPA developed unit labor burden and non-labor costs in the form of ***cost per CWS per year*** for the following public education materials:

- Public education to consumers served by lead, GRR, or unknown service lines once per year;
- Public education to all consumers twice per year for CWSs with a lead ALE; and
- Public education materials twice per year for CWSs with multiple lead ALEs.

Note that the EPA assumed that translation services for notification of tap sample results (as required under 40 CFR 141.85) would be negligible because the customers that receive these notifications are a small subset of all customers. Moreover, CWSs will have already had contact with the sampling population when providing sampling instructions. Similarly, the EPA assumes that translation services for service line disturbances would be negligible since they apply to a small portion (7.5 percent) of the subset of customers with a lead, GRR, or unknown service line. The EPA also assumed that State and local health departments are not likely to request translation of public education materials because the staff should be proficient in English in order to perform the expectations of their jobs.

For the three types of public education materials listed in the bullets above, the EPA developed unit burden for phone and written translation, as presented in Exhibit 4-117 and Exhibit 4-118, respectively. Note that burdens are only for systems serving more than 10,000 people because the State is assumed to provide all translation services (phone and written) for systems serving 10,000 or fewer people.

To determine the phone translation burden per year in Exhibit 4-117, the EPA multiplied the estimated per-call duration by the estimated average number of calls per year. The EPA estimated the per-call duration to be 15 to 30 minutes based on assumptions used in the Final CCR3 EA (USEPA, 2024a) for small systems. The EPA used the average of these two estimates (0.375 hours) for all system sizes. The EPA did not use the Final CCR 3 EA average call duration of 0.5 hours for systems serving more than 100,000 people because the LCRI public education materials are not expected to vary by size as was assumed for the CCRs.

The estimated number of calls per year depends on the type of public education materials. The EPA estimated nine calls per year for CWSs serving 10,000 or more people with a lead ALE based on data from the Final CCR3 EA on phone calls received by systems and States for translation support of CCRs (USEPA, 2024a). The EPA assumed that the number of calls for CCR translation would be the same as the number of calls for translation of public education materials following a lead ALE because both communications must be delivered to all customers. For CWSs with lead, GRR, or unknown service lines, the number of calls is estimated to be half, or four calls per year since the public education materials will be delivered to only a subset of customers (those

served by a lead, GRR, or unknown SL). The EPA assumes that systems with multiple lead ALEs will receive an additional nine calls beyond that estimated for a lead ALE in Column D of Exhibit 4-117. This estimate is based on the enhanced outreach required for systems with multiple lead ALEs that could result in more customers becoming aware of the ALEs and requesting translation assistance. The EPA assumed there are no non-labor costs to provide phone translation, consistent with the assumptions made in the Final CCR3 EA (USEPA, 2024a).

Exhibit 4-117: Unit Burden for CWSs to Provide Phone Translation by Type of Public Education Material

System Size (Population Served)	LOE per Translation	Public Education for Customers Served by Lead, GRR, and Unknown SL		Public Education for All Customers in CWSs with a Lead ALE		Public Education for All Customers in CWSs with Multiple Lead ALEs	
		Average Number of Phone Calls per Year	Total Translation Burden per CWS per Year *(SafeWater LCR Input: hrs_translate_phone_op)*	Average Number of Phone Calls per Year	Total Translation Burden per CWS per Year *(SafeWater LCR Input: hrs_translate_phone_op)*	Average Number of Phone Calls per Year	Total Translation Burden per CWS per Year *(SafeWater LCR Input: hrs_translate_phone_op)*
	A	B	C=A*B	D	E = A*D	F	G = A *F
≤100	0.375	0	0	0	0	0	0
101-500	0.375	0	0	0	0	0	0
501-1,000	0.375	0	0	0	0	0	0
1,001-3,300	0.375	0	0	0	0	0	0
3,301-10,000	0.375	0	0	0	0	0	0
10,001-50,000	0.375	4	1.5	9	3.375	9	3.375
50,001-100,000	0.375	4	1.5	9	3.375	9	3.375
100,001-1,000,000	0.375	4	1.5	9	3.375	9	3.375
>1,000,000	0.375	4	1.5	9	3.375	9	3.375

Acronyms: ALE = action level exceedance; CWS = community water system; GRR = galvanized requiring replacement; SL = service line.

Notes:

General: The EPA assumes that for phone translation services, CWSs serving more than 10,000 people will provide phone translation, whereas the State will provide phone translation for CWSs serving 10,000 or fewer people.

A: This is the average burden for a CWS to provide translation call-in support. The EPA assumed that these calls would be a duration of between 15 to 30 minutes, consistent with the assumptions for phone support for systems translating the CCR in the Final CCR3 EA (USEPA, 2024a).

B: The average number of calls per year for systems with lead, GRR or unknown service lines is estimated to be approximately half the number of calls estimated for the Final CCR3 EA because the education materials will be delivered to a subset of customers as opposed to all customers.

D: The average number of calls per year for systems that have a lead ALE is assumed to be the same as the number of calls anticipated for the CCR because the materials are being delivered to all customers. The estimate of nine calls per year is based on interviews with water systems related to phone calls requesting translation of their CCRs that were conducted to develop costs for CCR3.

F: The additional average number of calls per year for systems with multiple lead ALEs is based on enhanced outreach and more customers potentially becoming aware of the ALEs and requesting translation assistance. The EPA estimates that systems will receive double the calls requesting translation assistance based on this enhanced outreach. The number of calls shown is the incremental calls beyond the number that is estimated for a lead ALE in Column D.

To determine the unit cost per CWS per year for written translation, the EPA estimated the cost to translate each public education material multiplied by the number of languages and the number of documents being translated per year. To estimate costs of translating one public education document, the EPA reviewed public education templates and estimated that they are 1,000 words or less. The EPA then multiplied the 1,000 words by $0.20 per word, for a total of roughly $200. This $0.20 per word cost estimate is consistent with responses provided by water systems to the EPA during discussions of the cost to translate CCRs as part of developing the costs estimates for the Final CCR3 EA (USEPA, 2024a). The EPA made a simplifying assumption that the average cost for a contractor to translate one document would be the same regardless of system size and type of public education material.

To estimate the number of languages needed, the EPA reviewed ACS data (U.S. Census Bureau, 2022). The EPA estimated that systems serving more than 50,000 people will likely translate their materials into two languages because ACS data showed that systems of this size may have multiple languages spoken in their service area. Specifically, almost 90 percent of CWSs serving 100,000 or more and almost 50 percent of CWSs serving between 50,000-100,000 serve communities in which more than one language is spoken by at least 1,000 people or in five percent of the households in the service area (U.S. Census Bureau, 2022).

As was true for phone support, the average number of public education materials being translated per year depends on the type of material. The EPA assumed that systems with lead, GRR or unknown service lines will translate one document for notification of SL materials each year. CWSs that have a lead ALE are assumed to deliver public education materials that require translations twice per year; thus, the EPA assumed two translations. Systems with multiple lead ALEs may require additional translations to meet the requirements; therefore, the EPA assumed two additional written translations per year for systems with multiple lead ALEs. Exhibit 4-118 provides the unit cost for CWSs to provide a written translation for those with lead, GRR, or unknown service lines; a lead ALE; and multiple lead ALEs.

Exhibit 4-118: Unit Cost for CWSs to Provide Written Translation by Type of Public Education Material

System Size (Population Served)	Average Cost per Translated PE Material	Number of Languages	Public Education for Customers Served by Lead, GRR, and Unknown SL		Public Education for All Customers in CWSs with a Lead ALE		Public Education for All Customers in CWSs with Multiple Lead ALEs	
			Annual Number of PE Materials Being Translated	Total Translation Cost per CWS per Year *(SafeWater LCR Input: cost_translate_cws)*	Annual Number of PE Materials Being Translated	Total Translation Cost per CWS per Year *(SafeWater LCR Input: cost_translate_cws)*	Annual Number of PE Materials Being Translated	Total Translation Cost per CWS per Year *(SafeWater LCR Input: cost_translate_cws)*
			C	D = A*B*C	E	F = A*B*E	G	H = A*B*G
≤100	$200	1	0	$0	0	$0	0	$0
101-500	$200	1	0	$0	0	$0	0	$0
501-1,000	$200	1	0	$0	0	$0	0	$0
1,001-3,300	$200	1	0	$0	0	$0	0	$0
3,301-10,000	$200	1	0	$0	0	$0	0	$0
10,001-50,000	$200	1	1	$200	2	$400	2	$400
50,001-100,000	$200	2	1	$400	2	$800	2	$800
100,001-1,000,000	$200	2	1	$400	2	$800	2	$800
>1,000,000	$200	2	1	$400	2	$800	2	$800

Acronyms: ALE = action level exceedance; CWS = community water system; GRR = galvanized requiring replacement; PE = public education.

Notes:

General: The EPA assumes that for written translation services, CWSs serving more than 10,000 people will provide written translation, whereas the State will provide written translation for CWSs serving 10,000 or fewer people.

A: This is the estimated average cost for a the CWS to pay for contractor support to provide written translation service, based on a typical word count of public education materials of 1,000 multiplied by $0.20 per word for translation services.

B. Assumes one language for systems serving 10,000 or fewer people and two languages for systems serving more than 10,000 based on data from the ACS, which provided the population of metropolitan areas with limited English proficiency.

C: Assumes translation of one document per year for notification of SL material for customers served by a lead, GRR, or unknown service line.

E: Assumes one document per 6-month period for a total of two documents for CWSs with a lead ALE per year.

G: Assumes CWSs with multiple ALEs must produce one document per six-month period for a total of two additional documents per year. The number of written translations shown is the incremental written translations beyond the number that is estimated for a lead ALE in Column E.

s) ***Certify to the State that lead outreach was completed (hrs_pe_certify_quarterly_op, hrs_cert_outreach_annual_op***). CWSs have quarterly, semi-annual, and annual public education requirements in response to a lead ALE. Thus, CWSs must report the certification on a quarterly basis. The EPA estimated an average 0.33 and 0.5 hours to review public education certifications under the pre-2021 LCR based on data from North Carolina and Indiana, respectively. These are two States that responded to an ASDWA survey about LCR implementation. The EPA took these estimates to review a public education certification and doubled them because systems are expected to incur a larger burden for developing the materials than the States to review them.[137] These estimates were then multiplied by 0.75 to account for quarters in which there is less information to report on the self-certification. Then the numbers were multiplied by four to account for the quarterly frequency of the self-certification letter. The EPA assumed that each certification for systems serving 50,000 or fewer people would require 0.5 hours or 2 hours annually (based on the lower burden reported from North Carolina) and 0.75 hours/certification or 3 hours annually for CWSs serving more than 50,000 people (based on the higher burden reported from Indiana).

   NTNCWSs will also incur burden to certify to the State that they met their annual public education and outreach requirements (*hrs_cert_outreach_annual_op)*. The EPA assumed that NTNCWSs will submit an annual certification to the State electronically and incur a burden of 0.66 hours for systems serving 50,000 or fewer people and 1 hour for those serving more than 50,000 people. Estimates are based on input from North Carolina (0.33 hours) and Indiana (0.5 hours), respectively, for the burden to review the system's public education certification in response to a 2016 ASDWA survey about LCR implementation. Estimates were doubled since systems are expected to incur a larger burden to prepare the certification than needed for the State's review. A copy of the questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Note that this certification is assumed to include the consumer notice discussed in Section 4.3.6.1, activities that are required when a system exceeds the lead AL that are described in Section 4.3.6.3, and required activities when a system has multiple lead ALEs that are described in Section 4.3.6.4. In addition, under the final LCRI, systems must resubmit copies of their public education and outreach materials along with the certification.

Exhibit 4-119 provides details on how costs are calculated for PWS public education activities that apply regardless of a system's lead 90th percentile level for activities a) through s) including additional cost inputs that are required to calculate these costs.

[137] Based Exhibit 35 and 48 of the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (USEPA, 2022a), the system burden to prepare the public education certification (referred to as the Public Education letter) was 1 hour compared to 0.5 hours for the State review. The EPA increased the estimated burden based on input from North Carolina and Indiana but retained the relationship that systems would incur double the burden than the State.

Exhibit 4-119: PWS Lead Public Education Unit Costing Approach in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead–90th - Range	Other Conditions[2]	
a) Develop lead consumer notice materials and submit to the State for review				
The total hours per system multiplied by the system labor rate. *(hrs_consumer_notice_devel_op* rate_op)*	Cost applies as written to NTNCWS	All	All model PWSs	One time
b) Provide a copy of the consumer notice and certification to the State				
The total hours per system multiplied by the system labor rate. *(hrs_samp_notice_op*rate_op)*	Cost applies as written to NTNCWS	All	All model PWSs	Once per event
c) Update CCR language				
The total hours per system multiplied by the system labor rate. *(hrs_update_ccr_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	One time
d) Develop new customer outreach plan				
The total hours per system multiplied by the system labor rate. *(hrs_cust_plan_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead or unknown content	One time
e) Develop approach for improved public access to lead health-related information and tap sample results				
The total hours per system multiplied by the system labor rate. *(hrs_pub_access_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	One time
f) Establish a process for public access to information on known or potential lead content SL locations and tap sample results				
The total hours per system multiplied by the system labor rate. *(hrs_access_lsl_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead or unknown content	One time
g) Maintain a process for public access on lead health information, known or potential lead content SL locations, and tap sample results				
The total hours per system multiplied by the system labor rate. *(hrs_maint_lsl_op*rate_op)*	Cost does not apply to NTNCWSs.	All	All model PWSs	Once a year
h) Respond to customer requests for known or potential lead content SL information				
The number of requests from homeowners and residents multiplied by the total of the hours	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead or unknown content	Once a year

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead–90th - Range	Other Conditions[2]	
per request times the system labor rate, plus the material cost. *(pp_hh_request_lslr*(pws_pop/numb_hh))*((hrs_hh_request_op*rate_op)+cost_hh_request)*				
i) Respond to requests from realtors, home inspectors, and potential home buyers for known or potential lead content SL information				
The number of requests from realtors, home inspectors, and potential homebuyers multiplied by the total of the hours per request times the system labor rate, plus the material cost. *numb_other_request*((hrs_other_request_op*rate_op)+cost_other_request)*	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead or unknown content	Once a year
j) Develop list of local and State health agencies				
The number of State and local health agencies per system times the total hours per health agency multiplied by the system labor rate. *(numb_ha+1)*(hrs_hc_list_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
k) Develop lead outreach materials for local and State health agencies and submit to the State for review				
The total hours per system multiplied by the system labor rate. *(hrs_pub_devel_hc_op*rate_op)*	Cost applies as written to NTNCWSs.	All	All model PWSs	One time
l) Deliver lead outreach to State and local health agencies				
The number of State and local health agencies per system times the total hours per health agency multiplied by the system labor rate. *(numb_ha+1)*((hrs_hc_op*rate_op)+cost_hc)*	Cost applies as written to NTNCWSs.	All	All model PWSs	Once a year
m) Develop public education material for known or potential SL disturbances and submit to the State				
The total hours per system multiplied by the system labor rate. *(hrs_pub_devel_wtr_op*rate_op)*	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead or unknown content	One time

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead–90th - Range	Other Conditions[2]	
n) Deliver public education for SL disturbances				
The percentage of the households in the system having water work done multiplied by the total of the hours per household times the system labor rate, plus the material cost. *((hh_remain_lsl+hh_unknown_remain)*perc_hh_water_wrk)*((hrs_pub_deliv_wtr_op*rate_op)+cost_pub_deliv_wtr_ed)*	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead or unknown content	Once a year
o) Deliver filters and 6 months of replacement cartridges during disturbances of SLs				
The percentage of the households in the system having water work done multiplied by the total material cost. *((hh_remain_lsl+hh_unknown_remain)*perc_hh_water_wrk)*cost_filter_hh*	Cost does not apply to NTNCWSs.	All	Model PWSs with service lines of lead or unknown content	Once a year
p) Develop inventory-related outreach materials and submit to the State for review				
The total hours per system multiplied by the system labor rate. *hrs_pe_lsl_gen_develop_op*rate_op*	Cost applies as written to NTNCWSs.	All	All Model PWS with service lines of lead or unknown content	Once
q) Distribute inventory-related outreach materials				
The number of remaining households with LSLs or an unknown line multiplied by the hours per household and the system labor rate, plus the material cost per household. *(hh_remain_lsl+hh_unknown_remain)*((hrs_pe_lsl_gen_dist_op*rate_op)+cost_pe_lsl_gen)*	The total hours per system multiplied by the system labor rate, plus the material cost per system. *(hrs_ntncws_pe_lsl_gen_dist_op*rate_op)+cost_ntncws_pe_lsl_gen*	All	All Model PWS with service lines of lead or unknown content	Once per year
r) Provide translation services for public education materials				
The total hours per system multiplied by the system labor rate, plus the material cost. *(hrs_translate_phone_op*rate_op)+cost_translate_cws*	Cost does not apply to NTNCWSs.	Below AL	All model PWSs providing translation services either by telephone or written *p_translation* *p_translation_phone* *p_translation_phone_cws*	Once a year
The total hours per system multiplied by the system labor rate, plus the material cost.		Above AL		

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead–90th - Range	Other Conditions[2]	
*(hrs_translate_ale_phone_op*rate_op)+cost_translate_ale_cws*				
The total hours per system multiplied by the system labor rate, plus the material cost. *(hrs_translate_ale_phone_op*rate_op)+cost_translate_ale_cws*		Multiple ALEs		
s) Certify to State that lead outreach was completed				
The total hours per system multiplied by the system labor rate. *(hrs_pe_certify_quarterly_op*rate_op)*	The hours per system multiplied by the system labor rate. *hrs_cert_outreach_annual_op*rate_op*	All	All model PWSs	Once a year

Acronyms: AL = action level; ALE = action level exceedance; CCR = consumer confidence report; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system; SL = service line.

Notes:

[1] The data variables in the exhibit are defined previously in Sections 4.3.6.1 and 4.3.6.2 with the exception of:

- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] PWSs with lead content or unknown lines are identified using the data variables and approach described in Chapter 3, Section 3.3.4.

4.3.6.3 Public Education Activities in Response to Lead ALE

The final LCRI retains the public education requirements of the pre-2021 LCR for systems that exceed the lead AL and includes the 2021 LCRR requirement for systems to update their mandatory public education language. The EPA has developed system costs for these activities, as provided in Exhibit 4-120. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-120: PWS Public Education Burden in Response to Lead ALE

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
t) Update mandatory language for lead ALE public education and submit to the State for review (one-time)	7 hrs per CWS and NTNCWS	*hrs_pe_al_devel_op*

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
u) Deliver lead ALE public education materials to all customers	CWSs 0.0025 hours/household; $0.27 to $0.40/CWS NTNCWSs 1 hr/NTNCWS $0.079/NTNCWS	CWSs *hrs_distr_edu_op;* *cost_pe_lcr_delivery* NTNCWSs *hrs_ntncws_distr_edu_op;* *cost_ntncws_pe_lcr_delivery*
v) Post notice to website	0.5 hrs/CWSs serving > 50,000 people	*hrs_web_op*
w) Prepare press release	10 hrs/press release per CWS serving > 3,300 people; $0/press release	*hrs_pr_op;* *cost_pr*
x) Contact public health agencies to obtain additional organizations and update recipient list	0.5 hrs/CWSs serving ≤3,300 people; 1.5 hrs/CWSs serving 3,301 to 100,000 people; 2.5 hrs/CWS serving > 100,000 people	*hrs_ha_op*
y) Notify public health agencies and other organizations	0.0025 hours/organization/CWS; $5.97/organization/CWS	*hrs_distr_agencies_pe_op;* *cost_pe_lead_ale*
z) Consult with the State on other public education activities	2 hrs/CWS	*hrs_ale_consult_op*
aa) Implement other public education activities	2.7 to 1,039.2 hrs/CWS; $38.82 to $297,956/CWS	*hrs_ale_other_op;* *cost_ale_other*

Acronyms: ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Sources:

t), u): "Public Education Inputs_CWS_Final.xlsx"; "Public Education Inputs_NTNCWS_Final.xlsx."

v)-aa): "Public Education Inputs_CWS_Final.xlsx."

t) Update mandatory language for lead ALE public education and submit to the State for review (hrs_pe_al_devel_op). Under the final LCRI, CWSs and NTNCWSs with lead ALEs must update their mandatory health effects language and include additional steps to reduce lead exposure from drinking water such as the use of filters. The language must include an explanation that lead levels may vary and therefore lead exposure is possible even when tap sampling results do not detect lead at one point in time. For systems with lead, GRR, or unknown service lines, the materials must include SLR and service line material identification opportunities, how to obtain a copy or view the service line inventory and replacement plan, programs to assist with SLR, and the systems' responsibility to replace their portion of the lead or GRR service line when the property owner notifies them that the private-side portion is being replaced. The public education materials must also include instructions for consumers to notify the water system if they think the material classification is incorrect. The EPA assumed a one-time burden of 7 hours to update these materials. This burden estimate is based on the hours to prepare additional brochure language from Exhibit 33a of the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (USEPA, 2022a).

u) ***Deliver lead ALE public education materials to all customers (hrs_distr_edu_op, cost_pe_lcr_delivery, hrs_ntncws_distr_edu_op, cost_ntncws_pe_lcr_delivery).*** The final LCRI retains the prior public education requirements for CWSs to distribute public education to all households they serve (see Exhibit 4-112 for the estimated number of households (*numb_hh*)). The EPA estimates CWSs would require 15 minutes per 100 copies (0.0025 hours/household) to distribute public education materials (*hrs_distr_edu_op*). The estimate is based on assumptions for production labor used in the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule, Exhibit 17 (USEPA, 2007). CWSs will also incur the following material cost associated with delivery of annual lead PE in the water bill.[138] The EPA assumed 50 percent of systems will include lead public education in the water bill and only incur an additional cost for paper ($0.019) and ink ($0.06). The other 50 percent will mail a pamphlet and incur costs for paper ($0.019), ink ($0.06), an envelope ($0.092), and postage ($0.55). Systems serving more than 500 people will deliver more than 200 pamphlets and qualify for bulk-rate postage ($0.299). Thus, the average annual delivery cost per household (*cost_pe_lcr_delivery*) is $0.40 for. The cost formula is shown below for:

- CWSs serving ≤ 500 people = ($0.019+0.06)*50%)) + (($0.019 + $0.06 + $0.092 + 0.55) * 50%) = $0.40.
- CWSs serving > 500 people = ($0.019+0.06)*50%)) + (($0.019 + $0.06 + $0.092 + 0.299) * 50%) = $0.27.

The total burden per CWS is based on an estimated number of households, which is based on the system's served population. This approach may miss bill-paying customers that reside outside the water system service area and would underestimate the burden and cost.

The final LCRI also retains the prior public education requirements for NTNCWSs following a lead ALE. NTNCWSs are subject to different requirements for public education delivery than a CWS and can deliver material via email and public posting. The EPA assumed that NTNCWSs will deliver materials via email and post materials publicly with an estimated burden of 0.5 hours to develop/send e-mail and an additional 0.5 hours to post the materials, for a total of 1 hour (*hrs_ntncws_distr_edu_op*). NTNCWSs will also incur a cost for public education posted materials (*cost_ntncws_pe_lcr_delivery*) that will include paper costs of $0.019 and ink of $0.06 based on costs from 3 vendors (see file "General Cost Model Inputs_Final.xlsx" for more detail).

v) ***Post notice to website (hrs_web_op).*** Each CWS serving more than 50,000 people with a lead ALE must post public education materials on their website at an estimated annual burden of 0.5 hours per system. This estimate is based on the burden to post a notice on a website used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (page 57) (USEPA, 2007). Systems serving 50,000 or fewer people are not subject to this requirement.

w) ***Prepare press release (hrs_pr_op, cost_pr).*** The EPA assumed systems serving 3,300 or fewer will not prepare a press release because they deliver notices to all households individually as allowed under the rule. Systems serving more than 3,300 are estimated to require 5 hours per public

[138] CWSs are also required to include a brief lead informational statement on or in each water bill. The EPA assumed systems would incur negligible burden and no costs for this activity.

education event (two per year) for preparation and delivery to a total of 8 newspapers, radio stations, or TV stations for a total burden of 10 hours. The EPA assumed systems will not incur any material costs associated with these activities. For press releases (*cost_pr*), the EPA assumed that newspapers, radio stations, or TV stations will run the press release materials as a public service announcement (PSA), free of charge. In addition, systems are assumed to provide the press release and certification electronically. For additional information, see the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (Exhibit 31 (Labor Hours per PSA)) (USEPA, 2022a).

x) ***Contact public health agencies to obtain additional organizations and update recipient list (hrs_ha_op).*** CWSs must contact local health agencies to obtain a list of additional organizations that serve at-risk populations. The estimated number of health agencies (*numb_ha*) is provided in Exhibit 4-113. The EPA assumed that systems will elect to contact the public health agency by phone or in-person and spend on average 30 minutes (0.5 hours) per health agency to obtain a list of additional community-based organizations that should be contacted in response to a lead ALE (*hrs_ha_op*). The EPA assumed this contact would result in additional burden to update the list of organizations for systems serving more than 3,300 people. Specifically:

- Systems serving 3,301 to 100,000 people would incur an additional annual burden requirement of 1 hour per system to update the list of organizations for a total annual burden of 1.5 hours.
- Systems serving more than 100,000 people would incur an additional burden of 2 hours per system to update the list of organizations for a total of 2.5 hours.

These estimates are based on Appendix H-3 in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (USEPA, 2007).

y) ***Notify public health agencies and other organizations (hrs_distr_agencies_pe_op, cost_pe_lead_ale).*** CWSs must provide public education materials to facilities that include but are not limited to local public health agencies, schools, child care facilities, and medical providers that offer services to pregnant people, children, and infants to better reach these at-risk populations and their caregivers (*numb_lcr_other_org*). This input is provided in Exhibit 4-121.

- **Estimated hours to conduct outreach per organization.** The EPA assumed systems would require 15 minutes per 100 copies (0.0025 hours/organization) to produce the outreach for public health agencies and other organizations in response to a lead ALE (*hrs_distr_agencies_pe_op*). This estimate is based on assumptions for production labor used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (Exhibit 17) (USEPA, 2007).
- **Notify public health agencies and other organizations.** The EPA assumed CWSs will send one pamphlet per health agency and other organizations and ask these organization to make copies. The EPA assumed the information is delivered via certified mail at an estimated cost of $5.97 per organization. This total unit cost includes paper ($0.019), ink ($0.06), envelope ($0.092), and certified mail ($5.80) (*cost_pe_lead_ale*).

Exhibit 4-121: Number of Local Health Agencies, Schools, Child Care Facilities, and Targeted Medical Providers Proportionally Distributed by CWS Population Served

System Size (Population Served)	# of Systems	Population Served	Number of Agencies Proportionally Distributed	Number of Agencies per System	Number of Agencies per System (Rounded Up to Nearest Whole Number)
	A	B	C	D = C/A	E numb_lcr_other_org
≤100	11,732	708,236	2,173	0.2	1
101-500	15,084	3,830,126	11,752	0.8	1
501-1,000	5,330	3,931,488	12,063	2.3	3
1,001-3,300	7,967	15,218,647	46,695	5.9	6
3,301-10,000	5,026	29,565,710	90,716	18.0	19
10,001-50,000	3,374	74,162,674	227,553	67.4	68
50,001-100,000	571	39,629,417	121,595	213.0	213
100,001-1,000,000	421	99,359,362	304,864	724.1	725
>1,000,000	24	46,638,891	143,102	5,962.6	5,963
Total	49,529	313,044,551	960,513		

Source: "Public Education Inputs_CWS_Final.xlsx," worksheet, "Pb ALE_Recipients," Table 2a.
Notes:
General: CWSs must provide lead public education materials to facilities that include but are not limited to local public health agencies, schools, child care facilities, and medical providers that offer services to pregnant people, children, and infants to better reach these at-risk populations and their caregivers. The estimates do not explicitly include all groups that are required to receive public education, *i.e.*, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and Head Start, and public and private hospitals and clinics, family planning centers, and local welfare agencies. Note the omission of some of the organizations that receive public education will not impact the incremental costs of the final LCRI because this requirement is the same under the pre-2021 LCR, 2021 LCRR, and final LCRI.
A&B: From SDWIS/Fed, current through December 31, 2020.
C: Assumes the number of local health agencies and community-based organizations is proportionally distributed across the size categories.

z) ***Consult with State on other public education activities (hrs_ale_consult_op).*** CWSs will consult with their State on other required public education activities conducted in response to a lead ALE and will incur a burden of 2 hours per CWS. This assumption is based on the estimate to consult with the State on public education activities used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule*, page 60 (USEPA, 2007).

aa) ***Implement other public education activities (hrs_ale_other_op, cost_ale_other).*** CWSs with a lead ALE will also incur burden to implement other public education activities that use other delivery methods to inform consumers about the health effects of lead and ways to mitigate their exposure. Specifically, CWSs that exceed the lead ALE and serve more than 3,300 people must conduct

additional annual public education activities from a list specified in the rule in consultation with the State until the system no longer has a lead ALE. CWSs serving 3,300 or fewer people must select one activity. These activities and the EPA's burden assumptions are as follows:

- **Public Service Announcements (PSAs):** Systems will require 10 hours to prepare and e-mail a notification to newspapers and radio and TV stations.
- **Paid Ads:** Systems will require 0.5 hours to coordinate paid advertisements, which will be based on the information developed for the PSA. Thus, the EPA assumes minimal development burden.
- **Public Display**: Systems will post notices at local grocery stores, laundromats, or similar establishments. Systems serving 500 or fewer people would need 5 such postings, and systems serving between 501 and 10,000 people need 20 postings. Those serving 10,001 to 50,000 people need 100 postings, 50,001 to 100,000 need 200 postings, and 100,001 to 1,000,000 need 500 postings. It is assumed that it will take a system 1 hour to complete 5 postings.
- **Email Notification**: Systems will have a preexisting list of customer e-mail addresses and incur a burden of 1 hour.
- **Public Meetings**: Systems will incur burden for pre-meeting logistical arrangements, preparation of presentation/talking points, attending meeting, post-meeting activities (*e.g.*, develop and post meeting minutes). Estimates for each of these meeting components and the total estimated burden are included in Exhibit 4-122, Column E.
- **Material to Multifamily homes and institutions**: Systems will require 0.0025 hours/household, which is 15 minutes per 100 copies. This is multiplied by the average number of households per CWS (*numb_hh*) and the percentage of total occupied housing units that are multi-family units (13.1 percent).

The EPA assumed that each activity has an equal likelihood of being selected and thus, the average burden is used for *hrs_ale_other_op*. Burden estimates for systems serving more than 3,300 are multiplied by three because the rule requires these systems to conduct three activities whereas CWSs serving 3,300 or fewer people are required to conduct one activity. Burden estimates are included in Exhibit 4-123.

Exhibit 4-122: System Burden for Public Meetings

System Size (Population Served)	Pre-meeting logistical arrangements	Preparation of presentation/ talking points	Attend meeting	Post meeting, including notes	Total
	A	**B**	**C**	**D**	**E = A:D**
≤3,300	2	2	2	0	**6**
3,301-10,000	6	14	6	0	**26**
10,001-50,000	10	38	12	8	**68**
50,001-100,000	20	50	12	6	**88**

System Size (Population Served)	Pre-meeting logistical arrangements	Preparation of presentation/ talking points	Attend meeting	Post meeting, including notes	Total
	A	B	C	D	E = A:D
>100,000	20	50	30	28	**128**

Source: "Public Education Inputs_CWS_Final.xlsx."
Notes:
The EPA based estimates on the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (USEPA, 2007), Appendix Exhibits H-14 through H-17. This EA did not provide estimates for systems serving ≤3,300 people so the EPA adjusted the burden used for systems serving 3,301 to 10,000 people downward to develop the burden estimates for system serving ≤ 3,300 people. See notes A - D for additional detail.
A: Includes burden to select date, research and select site, negotiate with site for use, publicize meeting, set up room including electronics (microphones, sound system, and presentation).
B: Includes burden to prepare a 30-minute presentation (30-50 slides) including consultation with health experts and technical personnel as necessary, to receive feedback from management, and to practice presentation.
C: Estimate is based on DC Water (formerly called DC WASA): 1.5 hour open house, 1 hour presentation/Q&A, 15 minutes before and after, for a total of 3 hours, attended by two system representatives.
D: Includes burden to prepare and review meeting transcript or notes and follow up with attendees as appropriate.

Exhibit 4-123: System Burden for Additional Public Education Activities after a Lead ALE

System Size (Population Served)	PSA	Paid Ads	Public Display	Email Notification	Public Meetings	Delivery to all Households	Material to Multifamily homes and institutions	Average Burden for Additional Activities (per system)
	A	B	C	D	E	F	G	H
								hrs_ale_other_op
≤100	10	0.5	1	1	6	0.1	0.01	2.65
101-500	10	0.5	1	1	6	0.3	0.03	2.68
501-1,000	10	0.5	4	1	6	1	0.10	3.19
1,001-3,300	10	0.5	4	1	6	2	0.26	3.38
3,301-10,000	10	0.5	4	1	26	6	0.80	20.62
10,001-50,000	10	0.5	20	1	68	22	3.00	53.24
50,001-100,000	10	0.5	40	1	88	69	9.46	93.23
100,001-1,000,000	10	0.5	100	1	128	233	32.18	216.38
> 1,000,000	10	0.5	100	1	128	1,920	264.99	1,039.17

Sources/Assumptions:
Notes:
* General: The targeted customer contact is listed in the rule but was assumed not to be selected because those subsets of the population (*e.g.*, pregnant women and children) are contacted through other public education recipients, such as doctors, schools, and child care facilities.

A: Based on the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (Exhibit 31 (Labor Hours per PSA)) (USEPA, 2022a).
B: The EPA assumed a half hour to develop ad material with assistance from news outlet.
C: The EPA assumed systems will provide an increasingly larger number of postings per systems size and each would require one hour per five postings.
D: *Based on the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (Appendix Exhibit H-12) (USEPA, 2007).
E: See Exhibit 4-122.
F: Estimate is based on assumptions for production labor used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (Exhibit 17) (USEPA, 2007).
G: Includes multi-family unit burden and not institutions. The USEPA (2008a) CWS public education guidance does not discuss distributing information to institutions. Also, other public education requirements already include distribution to several organizations (*e.g.*, WIC, hospitals, medical clinics, pediatricians, family planning centers, etc.). Multi-family units (in buildings with 10 or more units) represent 13.8 percent of the total occupied housing units according to the 2019 American Community Survey (ACS) from the Census Bureau. (U.S. Census Bureau, 2019). 2019 data were used rather than 2020 data because the Census only released experimental estimates for the 2020 ACS due to COVID that impacted their data collection efforts.

These other public education activities have associated non-labor costs:

- **Paid Ads:** The EPA obtained estimates to run an ad from nine newspapers - three small, three medium, and three large based on circulation size, as shown in Exhibit 4-124. The last column provides the average cost based on circulation size. The EPA assumed that smaller systems will use small, local newspaper, whereas larger systems will use newspapers with wider circulation.
- **Public Meetings:** Includes the cost of a single-page handout ($0.079 = $0.019 for paper + $0.06 for ink) multiplied by the average number of households per system.
- **Delivery to all households**: Includes the cost of postage ($0.55 for ≤ 200 mailings) or ($0.299 for bulk rate of > 200 mailing), paper ($0.019), ink ($0.06) and envelopes ($0.092). These costs are multiplied by the average number of households per CWS.
- **Material to Multifamily homes and institutions:** Includes postage ($0.55), paper ($0.019), ink ($0.06), and envelopes ($0.092) per multifamily home. The bulk postage rate ($0.299) is used for systems mailing more than 200 pieces. These costs are multiplied by the average number of households per CWS and percentage of total occupied housing units that are multi-family units (13.1 percent).

Exhibit 4-124: Cost for Paid Ads (2021$)

Newspaper	Circulation Size Category	1/8 page	Average Cost per Circulation Size Category
Bozeman Daily Chronicle (Bozeman, MT)	Small	$215.80	$250
Wayne Independent (Honesdale, PA)	Small	$360.00	
Daily Astorian (Astoria, OR)	Small	$175.00	

Newspaper	Circulation Size Category	1/8 page	Average Cost per Circulation Size Category
Milwaukee Journal Sentinel (Milwaukee, WI)	Medium	$1,294.00	$1,888
Star Tribune (Minneapolis, MN)	Medium	$1,990.00	
Miami Herald (Miami, FL)	Medium	$2,380.00	
Chicago Tribune (Chicago, IL)	Large	$2,197.14	$4,328
LA Times (Los Angeles, CA)	Large	$1,517.25	
Washington Post (Washington, DC)	Large	$9,270.00	

Source: See file "Public Education Inputs_CWS_Final.xlsx, worksheet, "Pb ALE_Other Activity Detail", Table 2 for conversion of pricing to 1/8 page.
Notes:
1**.** Costs reflect non-Sunday rates, which are higher.
2. The EPA assumed that the newspaper develops advertisement based on base content provided by system. Costs reflect current costs per inch for 2021. The EPA also assumed that smaller systems will use small, local newspaper, whereas larger systems will use newspapers with wider circulation. See the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (USEPA, 2007).

To estimate the non-labor costs for the other required activities in response to a lead ALE (*cost_ale_other)*, the EPA assumed that each of the seven activities had an equal likelihood of being selected and summed the costs for each including those with $0 and divided by seven to get an average activity cost. The EPA multiplied the average activity cost by three for CWSs serving more than 3,300 people because the rule requires them to conduct three activities as opposed to one for CWSs serving 3,300 or fewer people. The resulting inputs for *cost_ale_other* are included in Exhibit 4-125.

Exhibit 4-125: System Non-Labor Costs for Additional Public Education Activities after a Lead ALE

System Size (Population Served)	PSA	Paid Ads	Public Display	Email Notification	Public Meetings	Delivery to all HHs	Material to Multifamily homes and institutions	Average Non-Labor Costs for Additional Activities (per system)
	A	B	C	D	E	F	G	H
								cost_ale_other
≤100	$0	$250	$0	$0	$1.89	$17.20	$2.37	$38.82
101-500	$0	$250	$0	$0	$7.93	$72.36	$9.99	$48.65
501-1,000	$0	$250	$0	$0	$23.03	$210.21	$29.01	$73.22
1,001-3,300	$0	$250	$0	$0	$59.65	$544.37	$75.12	$132.77
3,301-10,000	$0	$1,888	$0	$0	$183.68	$1,676.41	$231.34	$1,705.47
10,001-50,000	$0	$1,888	$0	$0	$686.35	$6,264.05	$864.44	$4,158.36
50,001-100,000	$0	$4,328	$0	$0	$2,167.15	$19,778.64	$2,729.45	$12,430.01
100,001-1,000,000	$0	$4,328	$0	$0	$7,369.42	$67,257.61	$9,281.55	$37,815.73
> 1,000,000	$0	$4,328	$0	$0	$60,679.72	$553,798.43	$76,424.18	$297,955.91

Notes:

General: The targeted customer contact is listed in the rule but was not included because the EPA assumed that subsets of the population (*e.g.*, pregnant women and children) are contacted through other public education recipients, such as doctors, schools, and child care facilities.

A: The EPA assumed that systems will deliver public education materials as a public service announcement (PSA), free of charge.

B: See file “Public Education Inputs_CWS_Final.xlsx, worksheet, “Pb ALE_Other Activity Detail”, Table 2 for conversion of pricing to 1/8 page.

C, D: No additional cost expected.

E: Estimate includes the cost of a single-page handout (paper = $0.019 + ink = 0.06) multiplied by the average number of households per system. See "General Cost Model Inputs_Final.xlsx" for additional information about costs for paper.

F: Estimate includes the cost of postage ($0.55), paper ($0.019), ink ($0.06), and envelopes ($0.067) multiplied by the average number of households per system. The bulk rate for postage ($0.299) is used when a system mails more than 200 pieces. See "General Cost Model Inputs_Final.xlsx" for additional information.

G: See "General Cost Model Inputs_Final.xlsx" for additional information about costs for postage, paper, and envelopes. Estimate includes multi-family unit cost and not institutions. The USEPA (2008a) CWS public education guidance does not discuss distributing information to institutions. Also, other public education requirements already include distribution to several organizations (*e.g.*, WIC, hospitals, medical clinics, pediatricians, family planning centers, etc.). Multi-family units (in buildings with 10 or more units) represent 13.8 percent of the total occupied housing units according to the 2019 ACS from the Census Bureau. 2019 data were used rather than 2020 data because the Census only released experimental estimates for the 2020 ACS due to COVID that impacted their data collection efforts.

Exhibit 4-126 provides details on how costs are calculated for PWS public education activities that occur when a system has an ALE in activities t) through aa) including additional cost inputs that are required to calculate these costs.

Exhibit 4-126: PWS Lead ALE Public Education Unit Costing Approach in SafeWater LCR by Activity[1]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
t) Update mandatory language for lead ALE public education and submit to State for review				
The total hours per system multiplied by the system labor rate. *(hrs_pe_al_devel_op*rate_op)*	Cost applies as written to NTNCWSs.	Above AL	All model PWSs	One time
u) Deliver lead ALE public education materials to all customers				
The number of households per system multiplied by the total of the hours per household times the system labor rate, plus the material cost. *(pws_pop/numb_hh)*((hrs_distr_edu_op*rate_op)+cost_pe_lcr_delivery)*	The hours per system multiplied by the system labor rate, plus the material cost. *((hrs_ntncws_distr_edu_op*rate_op)+cost_ntncws_pe_lcr_delivery)*	Above AL	All model PWSs	Once a year[2]
v) Post lead notice on website				
The total hours per system multiplied by the system labor rate. *(hrs_web_op*rate_op)*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs serving > 50,000 people	Once a year[2]
w) Prepare a press release				
The total hours per system multiplied by the system labor rate, plus the material cost. *hrs_pr_op * rate_op + cost_pr*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs serving > 3,300 people	Twice a year[2]
x) Contact public health agencies to obtain additional organizations and update recipient list				
The number of health agencies per system multiplied by the hours per health agency and the system labor rate. *numb_ha*(hrs_ha_op*rate_op)*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs	Once a year[2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions	
y) Notify public health agencies and other organizations				
The number of public health agencies and other organizations per system multiplied by the total of the hours per agency and organization times the system labor rate, plus the material cost. *numb_lcr_other_org * (hrs_distr_agencies_pe_op * rate_op + cost_pe_lead_ale)*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs	Once a year[2]
z) Consult with the State on other public education activities				
The total consultation hours per system multiplied by the system labor rate. *(hrs_ale_consult_op*rate_op)*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs	Once a year[2]
aa) Implement other public education activities				
The total hours per system multiplied by the system labor rate, plus the material cost. *(hrs_ale_other_op*rate_op)+cost_ale_other*	Cost does not apply to NTNCWSs.	Above AL	All model PWSs serving > 3,300 people	Once a year[2]

Acronyms: AL = action level; ALE = action level exceedance; CCR = consumer confidence report; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in Section 4.3.6.3 with the exception of:

- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).
- The required number of samples (either *numb_samp_customer* for systems on standard monitoring or *numb_reduced_tap* for systems on reduced monitoring) is based on the system's monitoring schedule. See Section 4.3.2.1.1 for details on how the SafeWater LCR model determines monitoring schedule and lead tap sampling requirements.

[2] A system can discontinue this requirement after it no longer exceeds the lead AL.

4.3.6.4 Public Education Activities in Response to Multiple Lead ALEs

The final LCRI requires water systems to develop a plan for making filters available if they have two lead ALEs in a five-year period.[139] Systems that have three or more lead ALEs in a rolling five-year period (*i.e.*, have multiple lead ALEs) must make filters available and provide enhanced public education. The EPA has developed system costs for these activities, as provided in Exhibit 4-127. The exhibit provides the unit burden and/or cost for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in

[139] Under the proposed LCRI, systems were not required to develop their filter plan until they had three lead ALEs in a five-year period.

red/italic font. Also refer to Chapter 3, Section 3.3.5.2 for a discussion of the likelihood a system will have at least two lead ALEs and multiple lead ALEs.

Exhibit 4-127: PWS Public Education Burden in Response to Multiple Lead ALEs

Activity	Unit Burden and/or Cost	*SafeWater LCR Data Variable*
bb) Develop plan for making filters available and submit to the State for review	5.5 hrs per CWS and 3 hrs per NTNCWS	*hrs_temp_filter_plan_dev_ op*
cc) Develop outreach materials for systems with multiple lead ALEs and submit to the State for review	7 hrs per CWS and NTNCWS	*hrs_devel_persist_ale_op*
dd) Conduct enhanced public education for systems with multiple lead ALEs	CWSs 28.1 to 131.7/yr $4.16 to $49,514/yr NTNCWSs 1 hr/NTNCWS	*hrs_deliv_persist_ale_op;* *cost_deliv_persist_ale* *hrs_ntncws_distr_pe_persist_ale_op*
ee) Consult with State on filter program for systems with multiple lead ALEs	2 to 8 hrs per CWS and NTNCWS	*hrs_consult_temp_pou_op*
ff) Administer filter program for systems with multiple lead ALEs	CWS and NTNCWSs 0.167 hrs/filter	*hrs_request_pou_op*
gg) Make filters available due to multiple lead ALEs	CWS and NTNCWSs $64/filter	*cost_temp_pou*

Acronyms: ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.
Sources: "Public Education Inputs_CWS_Final.xlsx"; "Public Education Inputs_NTNCWS_Final.xlsx."

bb) Develop plan for making filters available and submit to the State for review (hrs_temp_filter_plan_dev_op). After the second lead ALE, water systems must develop a plan that describes which methods the system will use to make filters and replacement cartridges available and document how the system will address barriers to customers obtaining filters. The plan is due to the State within 60 days after of the second lead ALE. For CWSs, the EPA assumed that the plan will be short and will be sent to the State via email. As part of planning, the EPA assumed that CWSs will add information on how to obtain a filter to their water bill or on their website, will make filters available at their office or other central location, and track filter distribution by adding a column to their service line inventory. The estimated burden for this activity is 5.5 hours for all system sizes and includes time to consult with internal staff and develop the plan (4 hrs), add instructions to the water bill or website (1 hr based on the time estimated to update the CCR, *hrs_update_ccr_op*), and modify their service line inventory to track filter distribution (assumed to be 0.5 hrs).

For NTNCWSs, the EPA assumes that they would provide filters at all taps as a simplifying assumption. The EPA estimates that NTNCWSs will spend 2 hours developing a plan that describes which methods the system will use to make filters and replacement cartridges available. The EPA assumes that NTNCWSs will spend an additional 1 hour providing information on the filters via email, based on *hrs_ntncws_distr_pe_persist_ale_op*, for a total of 3 hours for this activity for all system sizes.

cc) ***Develop outreach materials for systems with multiple lead ALEs and submit to the State for review (hrs_devel_persist_ale_op).*** CWSs and NTNCWSs that have at least three lead ALEs in a 5-year period (*i.e.*, have multiple lead ALEs) will incur a one-time burden of 7 hours to develop outreach materials and submit a copy to their State for review. The burden estimate is based on the hours to prepare additional brochure language from Exhibit 33a of the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)* (USEPA, 2022a). Although it is not required, under the LCRI, for water systems with multiple lead ALEs to provide their outreach materials for review, the EPA assumed systems would elect to provide these materials to their State.

dd) ***Conduct enhanced public education for systems with multiple lead ALEs (hrs_deliv_persist_ale_op, cost_deliv_persist_ale, hrs_ntncws_distr_pe_persist_ale_op).*** CWSs with multiple lead ALEs must conduct at least one enhanced community outreach activity every six months until they no longer exceed the lead ALE three times in a rolling 5-year period***.*** These activities include: Conducting a public meeting; participating in a community event; contacting customers by phone, text message, email, or doorhanger; conducting a social media campaign; or conducting other State-approved methods.

To estimate the burden to CWSs with multiple lead ALEs to deliver enhanced outreach materials, the EPA estimated the per system burden to conduct each of the seven specified activities in the rule (excluding other State-approved methods). These estimates are provided in Exhibit 4-128. The EPA assumed CWSs serving 3,300 or fewer people would have an equal likelihood of picking each activity and averaged them to estimate the burden for these systems to deliver enhanced outreach. The EPA assumed CWSs serving more than 3,300 people would elect not to contact customers using door hangers due to the burden and cost to conduct this activity and used the average of the other six delivery methods shown in Exhibit 4-128 to estimate the burden to deliver enhanced outreach. Also refer to the notes below the exhibit for additional EPA assumptions. The resulting per system burden is provided in Exhibit 4-129.

Exhibit 4-128: Community Water System Burden for Enhanced Outreach Following a Minimum of 3 Lead Action Level Exceedances in a 5-Year Period (per system per 6-month period)

Size Category (Population Served)	Public Meeting	Community Event	Contacting customers by phone	Contacting customers by text message	Contacting customers by email	Contacting customers using door hangers	Social Media Campaign
	A	B	C	D	E	F	G
≤100	6.0	6.0	6	1	1	2.4	76.0

Size Category (Population Served)	Public Meeting	Community Event	Contacting customers by phone	Contacting customers by text message	Contacting customers by email	Contacting customers using door hangers	Social Media Campaign
	A	B	C	D	E	F	G
101-500	6.0	6.0	25	1	1	8.8	76.0
501-1,000	6.0	6.0	73	1	1	25.1	76.0
1,001-3,300	6.0	6.0	1	1	1	64.5	76.0
3,301-10,000	26.0	26.0	1	1	1	N/A	76.0
10,001-50,000	68.0	68.0	1	1	1	N/A	76.0
50,001-100,000	88.0	88.0	1	1	1	N/A	136
100,001-1,000,000	128.0	128.0	1	1	1	N/A	136
>1,000,000	128.0	128.0	1	1	1	N/A	136

Source: "Public Education Inputs_CWS_Final.xlsx", worksheet, "Multiple ALEs."
Notes:
General: Assumes the EPA will have developed: 1) Key messaging document; 2) Sample social media posts for Facebook and Twitter; 3) Social media graphics; and 4) Guidance with social media best practices.
A: From "Public Education Inputs_CWS_Final.xlsx," worksheet, "Pb ALE_Other Activity Detail", Column E of Table 1: System Burden for Public Meetings.
B: The EPA assumed CWSs would incur the same burden to prepare for and attend a community event as a public meeting.
C: For CWSs serving 3,300 or fewer people, the EPA assumed a phone call to a household would average 15 minutes. This burden is converted to a per system burden by multiplying the burden times the number of households from "Public Education Inputs_CWS_Final.xlsx," worksheet, "Number of Households." For CWSs serving more than 3,300 people, the EPA assumed they would use a robocalling service and would incur a burden of 1 hour to coordinate with the company who is providing the service, as well as non-labor costs that are presented in Exhibit 4-130, Column C.
D & E: The EPA assumed that systems would have a pre-existing list of customers' phone and e-mail addresses. Estimate for email is based on the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule (Appendix Exhibit H-12). The EPA assumed the same burden to send the information by text.
F: Burden to deliver door hangers. The EPA assumes systems would spend on average 5 minutes per household to deliver a door hanger. This burden is converted to a per system burden by multiplying the burden times the number of households from worksheet, "Number of Households." Based on this assumption, the EPA assumed systems serving more than 3,300 people would not use this method because there are less burdensome alternatives available. For CWSs serving 3,300 or fewer, the EPA added the burden to drive round trip to a neighborhood at a speed of 25 miles per hour. The EPA estimated the one-way mileage to be 5 miles, or 10 miles roundtrip. See file, "Estimated Driving Distances_Final.xlsx," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov. The EPA assumed one round trip for systems serving 500 or fewer people, 2 round trips for systems serving 501 -1,000 people, and 4 round trips for those serving 1,001 - 3,300 people.
G: Refer to file, "Failure to Meet LSLR Goal_Final.xlsx," worksheet, "Social Media Campaign" for detailed assumptions. The EPA assumed systems serving 10,000 or fewer people would incur the same burden as those serving, 10,001 - 50,000 people.

Exhibit 4-129: Estimated Average Annual Burden to Conduct Enhanced Outreach for CWSs with Multiple Lead ALEs (per system)

Size Category (Population Served)	Average Burden per 6-month Period	Average Burden per Year (SafeWater LCR Input: *hrs_deliv_persist_ale_op*)
≤100	14.1	28.1
101-500	17.7	35.4
501-1,000	26.9	53.7
1,001-3,300	22.2	44.4
3,301-10,000	21.8	43.7
10,001-50,000	35.8	71.7
50,001-100,000	52.5	105.0
100,001-1,000,000	65.8	131.7
>1,000,000	65.8	131.7

Source: File **"**Public Education Inputs_CWS_Final.xlsx," worksheet, "Multiple Lead ALEs."

For NTNCWSs, the EPA assumed that systems would provide materials via email and that they would have a pre-existing list of customer e-mail addresses resulting in 1 hour of estimated burden (*hrs_ntncws_distr_pe_persist_ale_op*). This estimate is based on the Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule (Appendix Exhibit H-12).

To determine the cost for CWSs to deliver the enhanced public education materials, the EPA developed corresponding costs for the activities presented in Exhibit 4-128, which are shown in Exhibit 4-130 below. The EPA applied the same approach for estimating the system cost as the system burden. Specifically, for CWSs serving 3,300 or fewer people, the EPA used the average of all seven activities to estimate the non-labor costs for providing enhanced outreach. For those serving more than 3,300 people, the EPA used the average non-labor costs of all activities excluding door hangers. Also refer to the notes below the exhibit for additional EPA assumptions. The resulting per system non-labor costs to provide enhanced outreach is provided in Exhibit 4-131.

Exhibit 4-130: Community Water System Non-Labor Cost for Enhanced Outreach Following a Minimum of 3 Lead Action Level Exceedances in a 5-Year Period (per system per 6-month period)

Size Category (Population Served)	Public Meeting	Community Event	Contacting customers by phone	Contacting customers by text message	Contacting customers by email	Contacting customers using door hangers	Social Media Campaign
	A	B	C	D	E	F	G
≤100	$1.89	$1.89	$0.00	$0	$0	$10.80	$0
101-500	$7.93	$7.93	$0.00	$0	$0	$27.00	$0
501-1,000	$23.03	$23.03	$0.00	$0	$0	$73.23	$0
1,001-3,300	$59.65	$59.65	$44.02	$0	$0	$182.86	$0
3,301-10,000	$183.68	$183.68	$135.55	$0	$0	N/A	$0
10,001-50,000	$686.35	$686.35	$463.07	$0	$0	N/A	$0
50,001-100,000	$2,167.15	$2,167.15	$1,234.45	$0	$0	N/A	$300
100,001-1,000,000	$7,369.42	$7,369.42	$3,889.93	$0	$0	N/A	$300
>1,000,000	$60,679.72	$60,679.72	$28,189.18	$0	$0	N/A	$300

Source: “Public Education Inputs_CWS_Final.xlsx”, worksheet, “Multiple Lead ALEs.”

Notes:

General: Assumes the EPA will have developed: 1) Key messaging document; 2) Sample social media posts for Facebook and Twitter; 3) Social media graphics; and 4) Guidance with social media best practices.

A: From “Public Education Inputs_CWS_Final.xlsx”, worksheet, "Pb ALE_Other Activity Detail," Column E of Table 5: System Cost for Additional Public Education Activities after a Lead ALE.

B: The EPA assumed CWSs would incur the same costs to prepare for a community event as a public meeting.

C- E: The EPA assumed CWSs serving more than 3,300 people would use a robocalling service. The average cost from three companies (see file, "Robocall Pricing Estimates.xlsx") is multiplied by the number of households from Public Education Inputs_CWS_Final.xlsx,” worksheet "Number of Households to develop a per system cost.

F: Cost to deliver door hangers is the cost of the door hanger of $0.21 (see worksheet, Service Line Disturbances, Table 2b) times the number of households from the worksheet, "Number of Households." EPA assumed systems serving more than 3,300 people would not use this method because there are less costly alternatives available. For CWSs serving 3,300 or fewer, the EPA added the cost to drive round trip to a neighborhood at a mileage reimbursement rate of $0.575 (2020 mileage rate). The EPA estimated the one-way mileage to be 5 miles. See file, “Estimated Driving Distances_Final.xlsx,” available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov. The EPA assumed 1 round trip for systems serving 500 or fewer people, 2 round trips for systems serving 501 -1,000 people, and 4 round trips for those serving 1,001 - 3,300 people.

G: Refer to file, "Failure to Meet LSLR Goal_Final.xlsx," worksheet, "Social Media Campaign" for detailed assumptions.

Exhibit 4-131: Estimated Average Annual Non-Labor Costs to Conduct Enhanced Outreach for CWSs with Multiple Lead ALEs (per system)

Size Category (Population Served)	Average Cost per 6-month Period	Average Annual Cost *(SafeWater LCR Input: cost_deliv_persist_ale)*
≤100	$2.08	$4.16
101-500	$6.12	$12.25
501-1,000	$16.22	$32.44
1,001-3,300	$46.99	$93.98
3,301-10,000	$83.82	$167.64
10,001-50,000	$305.96	$611.92
50,001-100,000	$978.12	$1,956.25
100,001-1,000,000	$3,154.80	$6,309.59
>1,000,000	$24,974.77	$49,949.54

Source: "Public Education Inputs_CWS_Final.xlsx", worksheet, "Multiple Lead ALEs."

For NTNCWSs, the EPA assumed no non-labor costs because systems would distribute their enhanced outreach using email.

ee) Consult with the State on filter program for systems with multiple lead ALEs (hrs_consult_temp_pou_op). CWSs and NTNCWSs will incur burden to consult with the State on specific requirements for its filter program. The EPA estimated systems serving 3,300 or fewer people will require 2 hours, those serving 3,301 to 10,000 people will require 6 hours, and those serving more than 10,000 people will require 8 hours.

ff) Administer filter program for systems with multiple lead ALEs (hrs_request_pou_op). CWSs must also make pitcher filters available. The EPA assumes that systems will make filters available for pickup at a central location, and estimated burden to hand out filters and track who received them to be 0.167 hours per filter. The EPA assumes NTNCWSs will incur the same burden to track placement of filters on taps within their water system.

gg) Make filters available to multiple lead ALEs (cost_temp_pou). The EPA estimated the cost of a pitcher filter to be $64. See *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b) for additional detail. The EPA estimates that 20 percent of customers in CWSs would request a filter. As a simplifying assumption, the EPA estimates that NTNCWSs with multiple lead ALEs will provide filters at all of their taps.

Exhibit 4-132 provides details on how costs are calculated for PWS public education activities that occur when a system has multiple ALEs for activities bb) through gg) including additional cost inputs that are required to calculate these costs.

Exhibit 4-132: PWS Lead Multiple ALEs Public Education Unit Costing Approach in SafeWater LCR by Activity[1, 2]

CWS Cost Per Activity	NTNCWS Cost Per Activity	Conditions for Cost to Apply to a Model PWS		Frequency of Activity
		Lead 90th - Range	Other Conditions[2]	
bb) Develop plan for making filters available and submit to the State for review				
The total hours per system multiplied by the system labor rate, plus the material cost. (*hrs_temp_filter_plan_dev_op***rate_op*)	Cost applies as written to NTNCWS.	Above AL	All model PWSs with at least two lead ALEs	Once
cc) Develop outreach materials for systems with multiple lead ALEs and submit to State for review				
The total hours per system multiplied by the system labor rate. (*hrs_devel_persist_ale_op***rate_op)*	Cost applies as written to NTNCWS.	Above AL	All model PWSs with multiple lead ALEs	One time
dd) Conduct enhanced public education for systems with multiple lead ALEs				
The total hours per system multiplied by the system labor rate, plus the material cost. (*hrs_deliv_persist_ale_op*rate_op)+cost_deliv_persist_ale*	The hours per system multiplied by the system labor rate, plus the material cost. *(hrs_ntncws_distr_pe_persist_ale_op*rate_op)*	Above AL	All model PWSs with multiple lead ALEs	Once a year
ee) Consult with State on filter program due to multiple lead ALEs				
The total hours per system multiplied by the system labor rate, plus the material cost. *(hrs_consult_temp_pou_op*rate_op)*	Cost applies as written to NTNCWS.	Above AL	All model PWSs with multiple lead ALEs	Once
ff) Administer filter program due to multiple lead ALEs				
The total hours per filter multiplied by the system labor rate, plus the material cost. *num_temp_pou*(hrs_request_pou_op*rate_op)*		Above AL	All model PWSs with multiple lead ALEs	Once a year
gg) Make filters available due to multiple lead ALEs				
The total hours per filter multiplied by the material cost. *num_temp_pou***cost_temp_pou*	Cost applies as written to NTNCWS.	Above AL	All model PWSs with multiple lead ALEs	Once a year

Acronyms: AL = action level; ALE = action level exceedance; CCR = consumer confidence report; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in Section 4.3.6.4 with the exception of:

- *num_temp_pou* is the number of temporary filters provided by systems with multiple ALEs.
- *rate_op:* PWS hourly labor rate (Chapter 3, Section 3.3.11.1).

[2] The likelihood a system will have at least two or multiple lead ALEs is described in Chapter 3, Section 3.3.5.2.

4.3.6.5 Estimate of National Lead Public Education and Outreach Costs

As shown in Exhibit 4-133, the incremental estimated annualized lead public education and outreach costs range from $197.7 million to $230.1 million in 2022 dollars at a 2 percent discount rate.

Exhibit 4-133: Estimated National Annualized Public Education Costs – 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
General Lead in Drinking Water Public Education	$67.2	$221.1	$153.9	$65.9	$220.1	$154.2
Public Education Required after an ALE	$2.4	$5.4	$3.0	$6.2	$9.7	$3.5
Public Education, including filter provision, after multiple ALEs	$0.0	$40.8	$40.8	$0.0	$72.4	$72.4
Total Annual Public Education Costs	**$69.6**	**$267.3**	**$197.7**	**$72.1**	**$302.2**	**$230.1**

Acronyms: ALE = action level exceedance; LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

4.3.7 Summary of PWS Costs

This section summarizes the PWS impacts and costs of the major rule components of the final LCRI, including:

- PWS counts and population affected by rule components;
- national PWS costs by system category; and
- household costs by CWS size and source water type.

4.3.7.1 PWS counts and population affected by rule components

Exhibit 4-134 shows the number of PWSs and the population affected by each major rule requirement under the low and high cost scenarios, for the 2021 LCRR, the final LCRI and the increment. The table also shows the number of lead and GRR service lines that are expected to be replaced.

Exhibit 4-134: Estimated System Counts and Population Impacted (Over 35 Year Period of Analysis)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS Count	66,946	66,946	0	66,946	66,946	0
PWSs with SLR	25,425	25,823	398	25,501	25,823	322
Population impacted by SLR	1,577,551	21,714,621	20,137,070	2,471,476	21,720,307	19,248,831
SLR	489,820	6,885,738	6,395,918	776,687	6,885,742	6,109,055
PWSs that Install CCT	834	3,822	2,988	1,626	5,540	3,914
Population Affected by CCT Installation	4,339,763	8,606,323	4,266,560	9,746,077	14,735,535	4,989,458
PWSs that Re-Optimize CCT	1,703	2,243	540	2,858	3,566	708
Population Affected by CCT Re-Optimization	48,328,044	51,586,612	3,258,568	81,791,662	89,692,133	7,900,471
PWSs that Conduct DSSA of CCT	2,314	4,998	2,684	4,139	7,505	3,366
Population Affected by DSSA of CCT	49,783,958	55,458,627	5,674,669	87,752,600	98,002,604	10,250,004
PWSs that Install POU	1,273	2,406	1,133	2,769	4,066	1,297
Population Affected by POU Installation	263,970	250,048	-13,922	578,331	474,266	-104,065

Acronyms: CCT = corrosion control treatment; DSSA = Distribution System and Site Assessment; LCRI = Lead and Copper Rule Improvements; POU = point-of-use; PWS = public water system; SLR = service line replacement.

4.3.7.2 Estimated Cost per Public Water System by System Category

Exhibit 4-135 shows the estimated annualized national PWS low cost scenario estimates for the 2021 LCRR, the final LCRI, and the incremental costs by system type, primary source water, and system size category for CWSs. The high cost scenario estimates for CWSs are shown in Exhibit 4-136. The same information for the low and high cost scenarios for NTNCWSs are provided in Exhibit 4-137 and Exhibit 4-138, respectively.

Exhibit 4-135: Estimated Annualized Incremental Cost per CWS – Low Scenario (2022 USD)

Funding	*Source Water*	*Size*	*Mean*	*10th Percentile*	*25th Percentile*	*50th Percentile*	*75th Percentile*	*90th Percentile*
Private	*Ground*	*≤100*	$2,519	$1,810	$1,891	$2,035	$3,056	$3,716
Private	*Ground*	*101 to 500*	$2,854	$1,629	$1,829	$1,929	$3,458	$4,742
Private	*Ground*	*501 to 1,000*	$3,539	$1,029	$1,134	$2,210	$4,632	$6,419
Private	*Ground*	*1,001 to 3,300*	$5,085	$1,722	$1,906	$2,024	$6,556	$9,431
Private	*Ground*	*3,301 to 10,000*	$22,860	-$367	$2,170	$12,163	$37,463	$66,220
Private	*Ground*	*10,001 to 50,000*	$151,929	$2,893	$10,985	$120,197	$223,328	$368,730
Private	*Ground*	*50,001 to 100,000*	$520,919	$2,004	$16,427	$543,510	$779,446	$1,069,141
Private	*Ground*	*100,001 to 1,000,000*	$852,161	$6,292	$38,359	$578,756	$1,130,427	$2,114,840
Private	*Surface*	*≤100*	$2,520	$1,817	$1,897	$2,076	$3,060	$3,683
Private	*Surface*	*101 to 500*	$3,039	$1,779	$1,843	$1,985	$3,747	$5,163
Private	*Surface*	*501 to 1,000*	$3,744	$1,476	$1,851	$1,963	$4,764	$6,925
Private	*Surface*	*1,001 to 3,300*	$6,125	$1,884	$1,916	$2,591	$7,725	$10,294
Private	*Surface*	*3,301 to 10,000*	$27,577	$1,472	$2,314	$17,828	$43,837	$74,106
Private	*Surface*	*10,001 to 50,000*	$160,481	$3,160	$11,092	$107,870	$235,375	$409,499
Private	*Surface*	*50,001 to 100,000*	$473,773	$3,567	$115,893	$479,886	$729,827	$946,664
Private	*Surface*	*100,001 to 1,000,000*	$1,446,832	$9,035	$39,505	$880,444	$1,815,169	$2,727,948
Private	*Surface*	*>1,000,000*	$2,007,743	$1,399,180	$1,400,795	$2,444,699	$2,450,057	$2,650,827
Public	*Ground*	*≤100*	$2,533	$1,938	$2,002	$2,137	$2,782	$3,538
Public	*Ground*	*101 to 500*	$3,037	$1,864	$1,942	$2,049	$3,510	$4,716
Public	*Ground*	*501 to 1,000*	$3,675	$1,479	$1,571	$2,100	$4,615	$6,697
Public	*Ground*	*1,001 to 3,300*	$5,322	$1,945	$1,994	$2,454	$6,421	$9,999
Public	*Ground*	*3,301 to 10,000*	$22,967	$601	$2,296	$13,824	$37,685	$65,058
Public	*Ground*	*10,001 to 50,000*	$130,277	$2,913	$12,782	$98,611	$195,252	$310,620
Public	*Ground*	*50,001 to 100,000*	$423,629	$2,273	$102,386	$458,218	$667,395	$849,936

Funding	Source Water	Size	Mean	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Public	*Ground*	*100,001 to 1,000,000*	$1,384,551	$10,143	$224,794	$1,052,551	$1,695,260	$2,601,212
Public	*Ground*	*>1,000,000*	$1,696,007	$418,697	$420,267	$2,659,726	$2,723,821	$2,818,505
Public	*Surface*	*≤100*	$2,459	$1,955	$2,032	$2,159	$2,716	$3,245
Public	*Surface*	*101 to 500*	$3,054	$1,898	$1,954	$2,093	$3,638	$4,799
Public	*Surface*	*501 to 1,000*	$3,845	$1,689	$1,964	$2,158	$4,601	$7,142
Public	*Surface*	*1,001 to 3,300*	$5,782	$1,918	$2,007	$2,544	$6,738	$10,133
Public	*Surface*	*3,301 to 10,000*	$26,364	$1,825	$2,384	$17,362	$43,850	$71,233
Public	*Surface*	*10,001 to 50,000*	$143,832	$6,831	$12,914	$107,196	$221,667	$345,924
Public	*Surface*	*50,001 to 100,000*	$417,167	$3,633	$30,743	$437,909	$663,263	$860,490
Public	*Surface*	*100,001 to 1,000,000*	$1,487,491	$11,540	$99,596	$1,107,748	$1,916,177	$3,441,197
Public	*Surface*	*>1,000,000*	$3,296,734	$388,527	$1,212,339	$2,518,070	$3,286,896	$6,576,694

Acronyms: USD = United States dollar.
Notes: System Category rows are not included for system categories that contain zero systems.
When evaluating the economic impacts on PWSs, the EPA uses the estimated PWS cost of capital to discount future costs (not the 2 percent discount rate used to evaluate social costs and benefit), as this best represents the actual costs of compliance that water systems would incur over time. For more information on cost of capital, see Section 4.2.3.3.

Exhibit 4-136: Estimated Annualized Incremental Cost per CWS – High Scenario (2022 USD)

Funding	Source Water	Size	Mean	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Private	Ground	≤100	$2,427	$1,430	$1,874	$1,969	$3,041	$3,887
Private	Ground	101 to 500	$2,796	$619	$1,821	$1,901	$3,593	$5,516
Private	Ground	501 to 1,000	$3,690	$998	$1,109	$1,929	$4,951	$7,625
Private	Ground	1,001 to 3,300	$5,439	$1,151	$1,893	$2,003	$7,125	$10,610
Private	Ground	3,301 to 10,000	$29,825	-$4,227	$2,180	$14,643	$47,781	$90,472
Private	Ground	10,001 to 50,000	$210,412	$2,911	$12,575	$147,788	$301,893	$485,814
Private	Ground	50,001 to 100,000	$732,647	$2,192	$137,451	$751,544	$1,135,675	$1,532,014
Private	Ground	100,001 to 1,000,000	$1,189,604	$6,016	$27,528	$783,023	$1,573,335	$2,727,490
Private	Surface	≤100	$2,431	$1,526	$1,872	$1,977	$3,104	$3,888
Private	Surface	101 to 500	$2,903	$605	$1,818	$1,903	$3,810	$5,719
Private	Surface	501 to 1,000	$3,909	$1,045	$1,829	$1,931	$4,943	$7,493
Private	Surface	1,001 to 3,300	$6,725	$1,475	$1,892	$1,994	$8,056	$12,655
Private	Surface	3,301 to 10,000	$35,803	-$1,298	$2,246	$16,836	$54,668	$104,858
Private	Surface	10,001 to 50,000	$216,071	$3,011	$10,910	$130,403	$327,595	$565,149
Private	Surface	50,001 to 100,000	$664,920	$3,542	$112,602	$681,019	$1,026,824	$1,301,522
Private	Surface	100,001 to 1,000,000	$1,970,415	$7,941	$15,737	$1,302,530	$2,477,142	$3,839,989
Private	Surface	>1,000,000	$2,643,810	$1,795,314	$1,797,301	$3,172,334	$3,188,453	$3,440,641
Public	Ground	≤100	$2,519	$1,669	$1,997	$2,090	$2,814	$3,766
Public	Ground	101 to 500	$3,130	$1,174	$1,929	$2,015	$3,619	$5,714
Public	Ground	501 to 1,000	$3,975	$1,458	$1,567	$2,117	$4,857	$8,136
Public	Ground	1,001 to 3,300	$6,080	$1,719	$1,983	$2,066	$6,911	$11,206
Public	Ground	3,301 to 10,000	$28,850	-$3,072	$1,932	$14,120	$45,553	$87,586
Public	Ground	10,001 to 50,000	$181,705	$2,922	$12,501	$130,318	$277,217	$461,521
Public	Ground	50,001 to 100,000	$599,079	$2,076	$102,910	$647,708	$940,339	$1,225,129

Funding	Source Water	Size	Mean	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Public	*Ground*	*100,001 to 1,000,000*	$1,933,944	$9,289289	$300,590	$1,446,859	$2,378,070	$3,490,476
Public	*Ground*	*>1,000,000*	$2,250,767	$432,092	$433,958	$3,511,114	$3,659,136	$3,957,839
Public	*Surface*	*≤100*	$2,383	$1,602	$1,995	$2,092	$2,737	$3,349
Public	*Surface*	*101 to 500*	$3,110	$1,103	$1,927	$2,024	$3,825	$5,723
Public	*Surface*	*501 to 1,000*	$3,987	$1,112	$1,939	$2,062	$5,022	$8,069
Public	*Surface*	*1,001 to 3,300*	$6,496	$1,775	$1,983	$2,295	$7,271	$11,782
Public	*Surface*	*3,301 to 10,000*	$33,286	$442	$2,326	$19,620	$54,550	$99,968
Public	*Surface*	*10,001 to 50,000*	$198,710	$4,992	$11,799	$148,064	$301,159	$501,063
Public	*Surface*	*50,001 to 100,000*	$579,102	$3,350	$23,030	$592,831	$933,176	$1,239,996
Public	*Surface*	*100,001 to 1,000,000*	$2,072,128	$11,278	$124,059	$1,545,207	$2,597,966	$4,929,156
Public	*Surface*	*>1,000,000*	$4,442,763	$392,442	$1,541,232	$3,422,413	$4,437,768	$8,865,809

Acronyms: USD = United States dollar.
Notes: System Category rows are not included for system categories that contain zero systems.
When evaluating the economic impacts on PWSs, the EPA uses the estimated PWS cost of capital to discount future costs (not the 2 percent discount rate used to evaluate social costs and benefit), as this best represents the actual costs of compliance that water systems would incur over time. For more information on cost of capital, see Section 4.2.3.3.

Exhibit 4-137: Estimated Annualized Incremental Cost per NTNCWS – Low Scenario (2022 USD)

Funding	Source Water	Size	Mean	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Private	Ground	≤100	$765	$6	$76	$106	$163	$1,450
Private	Ground	100 to 500	$713	-$2	$91	$116	$166	$525
Private	Ground	500 to 1,000	$585	-$444	-$439	-$381	-$174	$1,400
Private	Ground	1,000 to 3,300	$709	-$202	$40	$77	$114	$538
Private	Ground	3,300 to 10,000	$750	-$1,003	-$989	-$891	-$722	$964
Private	Ground	10,000 to 50,000	$3,803	-$1,005	-$123	$49	$214	$5,761
Private	Surface	≤100	$735	$31	$79	$109	$168	$1,054
Private	Surface	100 to 500	$598	-$191	-$188	-$129	-$60	$1,471
Private	Surface	500 to 1,000	$703	-$378	-$68	$82	$135	$1,588
Private	Surface	1,000 to 3,300	$735	-$377	-$172	$61	$102	$815
Private	Surface	3,300 to 10,000	$1,318	-$872	-$290	$63	$136	$477
Private	Surface	10,000 to 50,000	$3,058	-$1,436	-$625	$23	$164	$5,221
Private	Surface	100,000 to 1,000,000	$4,760	-$2,507	-$1,371	-$615	-$397	-$337
Public	Ground	≤100	$741	$36	$52	$97	$146	$1,229
Public	Ground	100 to 500	$681	$24	$70	$103	$153	$595
Public	Ground	500 to 1,000	$665	-$257	-$251	-$189	$36	$1,181
Public	Ground	1,000 to 3,300	$840	-$139	$48	$72	$105	$590
Public	Ground	3,300 to 10,000	$1,369	-$746	-$730	-$639	-$456	$2,882
Public	Ground	10,000 to 50,000	$4,088	-$974	-$18	$61	$1,886	$5,822
Public	Surface	≤100	$719	$40	$52	$96	$142	$508
Public	Surface	100 to 500	$726	-$99	-$77	-$32	$18	$711
Public	Surface	500 to 1,000	$810	-$218	-$9	$72	$122	$2,021
Public	Surface	1,000 to 3,300	$1,010	-$163	$22	$53	$94	$2,047

Funding	Source Water	Size	Mean	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Public	*Surface*	*3,300 to 10,000*	$1,827	-$652	-$163	$71	$140	$4,092
Public	*Surface*	*10,000 to 50,000*	$4,671	-$1,153	-$437	$40	$147	$5,310
Public	*Surface*	*50,000 to 100,000*	$2,390	-$1,707	-$916	-$862	-$509	-$469

Acronyms: USD = United States dollar.
Notes: System Category rows are not included for system categories that contain zero systems. Under the final LCRI, PWSs without SL with lead content benefit from significantly reduced tap water sampling requirements. Since NTNCWSs have very few SLs with lead content, the cost of replacing these SLs is more than offset by the savings in tap water sampling costs. Therefore, a portion of NTNCWSs will see a decrease in compliance costs under the LCRI as compared to the 2021 LCRR.
When evaluating the economic impacts on PWSs, the EPA uses the estimated PWS cost of capital to discount future costs (not the 2 percent discount rate used to evaluate social costs and benefit), as this best represents the actual costs of compliance that water systems would incur over time. For more information on cost of capital, see Section 4.2.3.3.

Exhibit 4-138: Estimated Annualized Incremental Cost per NTNCWS – High Scenario (2022 USD)

Funding	Source Water	Size	Mean	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Private	*Ground*	*≤100*	$1,017	-$2	$72	$104	$165	$3,749
Private	*Ground*	*100 to 500*	$1,097	-$19	$91	$112	$175	$3,770
Private	*Ground*	*500 to 1,000*	$858	-$447	-$439	-$376	-$121	$3,196
Private	*Ground*	*1,000 to 3,300*	$1,056	-$414	$30	$68	$116	$3,796
Private	*Ground*	*3,300 to 10,000*	$776	-$1,027	-$997	-$937	-$727	$4,346
Private	*Ground*	*10,000 to 50,000*	$2,590	-$1,498	-$427	$43	$237	$5,763
Private	*Surface*	*≤100*	$1,051	$14	$78	$106	$171	$5,210
Private	*Surface*	*100 to 500*	$1,059	-$200	-$188	-$148	-$60	$5,444
Private	*Surface*	*500 to 1,000*	$891	-$439	-$130	$72	$128	$2,740
Private	*Surface*	*1,000 to 3,300*	$869	-$458	-$234	$61	$101	$2,501
Private	*Surface*	*3,300 to 10,000*	$1,581	-$985	-$404	$46	$135	$3,212

Funding	*Source Water*	*Size*	*Mean*	*10th Percentile*	*25th Percentile*	*50th Percentile*	*75th Percentile*	*90th Percentile*
Private	*Surface*	*10,000 to 50,000*	$2,624	-$1,467	-$586	$28	$167	$5,251
Private	*Surface*	*100,000 to 1,000,000*	$7,660	-$2,727	-$1,487	-$657	-$429	$6,330
Public	*Ground*	*≤100*	$1,130	$33	$52	$96	$147	$5,669
Public	*Ground*	*100 to 500*	$961	-$5	$68	$98	$154	$2,566
Public	*Ground*	*500 to 1,000*	$1,069	-$258	-$251	-$191	$46	$4,705
Public	*Ground*	*1,000 to 3,300*	$1,099	-$188	$39	$64	$97	$2,430
Public	*Ground*	*3,300 to 10,000*	$1,171	-$764	-$734	-$656	-$438	$2,617
Public	*Ground*	*10,000 to 50,000*	$4,181	-$1,159	-$248	$59	$3,203	$6,784
Public	*Surface*	*≤100*	$1,079	$36	$52	$95	$146	$3,718
Public	*Surface*	*100 to 500*	$1,132	-$106	-$95	-$52	$9	$5,323
Public	*Surface*	*500 to 1,000*	$1,118	-$234	-$18	$69	$121	$4,218
Public	*Surface*	*1,000 to 3,300*	$1,247	-$263	$12	$55	$103	$4,165
Public	*Surface*	*3,300 to 10,000*	$1,727	-$692	-$233	$46	$138	$4,409
Public	*Surface*	*10,000 to 50,000*	$4,573	-$1,209	-$512	$11	$170	$10,791
Public	*Surface*	*50,000 to 100,000*	$2,379	-$1,917	-$960	-$902	-$546	$7,170

Acronyms: USD = United States dollar.

Notes: System Category rows are not included for system categories that contain zero systems. Since NTNCWSs have very few SLs with lead content, the cost of replacing these SLs is more than offset by the savings in tap water sampling costs. Therefore, a portion of NTNCWSs will see a decrease in compliance costs under the LCRI as compared to the 2021 LCRR.

When evaluating the economic impacts on PWSs, the EPA uses the estimated PWS cost of capital to discount future costs (not the 2 percent discount rate used to evaluate social costs and benefit), as this best represents the actual costs of compliance that water systems would incur over time. For more information on cost of capital, see Section 4.2.3.3.

4.3.7.3 Household Costs by CWS Size and Source Water Type

The SafeWater LCR model calculates the annualized total cost per household assuming that all regulatory costs are passed on to consumers.[140] The SafeWater LCR model first calculates the cost per gallon of water produced by the model PWS:

$$\text{Cost per gallon}_{cws} = \text{Annualized Total CWS Cost} / (\text{Average Daily Flow}_{cws} * 365 \times 1{,}000)$$

It then multiplies this cost per gallon by the average annual household consumption (in gallons) to determine the model PWS's average annual household cost:

$$\text{Average Annual Household Cost} = \text{Annual Household Consumption} * \text{Cost per gallon}_{cws}$$

Exhibit 4-139 and Exhibit 4-140 show the distribution of LCRI incremental annualized costs for CWS households by primary water source and size category for the low and high scenarios, respectively. Note: the percentiles represent the distribution of average household costs among CWSs in a category not the distribution of costs across all households in a CWS category. The incremental annualized per household cost estimates presented in Exhibit 4-139 and Exhibit 4-140 may overestimate actual costs given the potential that systems could obtain grants to offset the cost of SLR or other LCRI related activities through the Drinking Water State Revolving Fund or other funding sources.

[140] Note that the EPA assumes that all SLR costs are borne by the PWS in the analysis of the proposed LCRI.

Exhibit 4-139: Estimated Annualized Incremental Cost per Household – Low Scenario (2022 USD)

Funding	*Source Water*	*Size*	*Mean*	*10th Percentile*	*25th Percentile*	*50th Percentile*	*75th Percentile*	*90th Percentile*
Private	*Ground*	*≤100*	$67.10	$28.10	$39.80	$57.80	$89.00	$117.00
Private	*Ground*	*100 to 500*	$22.50	$6.40	$11.40	$19.40	$28.10	$43.50
Private	*Ground*	*500 to 1,000*	$4.60	$1.20	$1.60	$3.00	$6.10	$8.50
Private	*Ground*	*1,000 to 3,300*	$2.70	$0.60	$0.90	$1.60	$3.60	$4.80
Private	*Ground*	*3,300 to 10,000*	$8.50	-$0.20	$0.60	$5.00	$14.50	$25.00
Private	*Ground*	*10,000 to 50,000*	$6.50	$0.10	$0.60	$6.40	$11.20	$14.30
Private	*Ground*	*50,000 to 100,000*	$7.50	$0.00	$0.30	$8.70	$11.70	$13.90
Private	*Ground*	*100,000 to 1,000,000*	$4.70	$0.00	$0.20	$3.80	$8.50	$9.70
Private	*Surface*	*≤100*	$59.20	$23.40	$32.80	$50.90	$78.60	$106.40
Private	*Surface*	*100 to 500*	$17.70	$5.60	$8.40	$15.00	$22.40	$33.70
Private	*Surface*	*500 to 1,000*	$4.30	$1.50	$1.90	$2.80	$5.20	$8.70
Private	*Surface*	*1,000 to 3,300*	$2.60	$0.60	$0.70	$1.40	$3.20	$4.60
Private	*Surface*	*3,300 to 10,000*	$9.70	$0.30	$0.80	$6.40	$15.30	$26.20
Private	*Surface*	*10,000 to 50,000*	$5.50	$0.20	$0.50	$4.70	$9.60	$13.00
Private	*Surface*	*50,000 to 100,000*	$7.00	$0.00	$2.00	$7.90	$10.90	$13.80
Private	*Surface*	*100,000 to 1,000,000*	$5.70	$0.00	$0.20	$6.10	$9.70	$12.10
Private	*Surface*	*>1,000,000*	$1.90	$1.30	$1.30	$2.40	$2.40	$2.60
Public	*Ground*	*≤100*	$52.20	$23.40	$31.60	$43.50	$69.50	$93.90
Public	*Ground*	*100 to 500*	$14.80	$4.90	$7.40	$11.80	$18.60	$28.10
Public	*Ground*	*500 to 1,000*	$3.70	$1.20	$1.60	$2.50	$4.40	$6.70
Public	*Ground*	*1,000 to 3,300*	$2.00	$0.50	$0.70	$1.30	$2.50	$3.50
Public	*Ground*	*3,300 to 10,000*	$7.10	$0.20	$0.60	$4.30	$11.30	$19.30
Public	*Ground*	*10,000 to 50,000*	$4.50	$0.10	$0.50	$4.00	$7.30	$10.20
Public	*Ground*	*50,000 to 100,000*	$5.20	$0.00	$0.90	$6.00	$8.20	$9.90

Funding	Source Water	Size	Mean	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Public	*Ground*	*100,000 to 1,000,000*	$5.20	$0.00	$1.20	$6.30	$8.00	$9.60
Public	*Ground*	*>1,000,000*	$0.60	$0.30	$0.30	$0.80	$0.80	$0.90
Public	*Surface*	*≤100*	$54.30	$21.00	$29.70	$52.50	$72.20	$90.30
Public	*Surface*	*100 to 500*	$12.60	$4.40	$6.30	$10.20	$15.50	$23.60
Public	*Surface*	*500 to 1,000*	$3.50	$1.30	$1.60	$2.40	$4.20	$6.40
Public	*Surface*	*1,000 to 3,300*	$2.00	$0.50	$0.70	$1.20	$2.30	$3.40
Public	*Surface*	*3,300 to 10,000*	$7.90	$0.50	$0.80	$5.30	$12.90	$20.60
Public	*Surface*	*10,000 to 50,000*	$5.00	$0.20	$0.60	$4.60	$8.40	$11.10
Public	*Surface*	*50,000 to 100,000*	$5.90	$0.00	$0.40	$6.50	$9.50	$11.80
Public	*Surface*	*100,000 to 1,000,000*	$6.50	$0.10	$0.50	$7.60	$10.00	$12.10
Public	*Surface*	*>1,000,000*	$2.40	$0.30	$0.60	$2.00	$2.40	$5.00

Acronyms: USD = United States dollar.
Notes: System Category rows are not included for system categories that contain zero systems.
When evaluating the economic impacts on households, the EPA uses the estimated PWS cost of capital to discount future costs (not the 2 percent discount rate used to evaluate social costs and benefit) because this best represents the actual costs of compliance that water systems would incur over time. For more information on cost of capital, see Section 4.2.3.3.

Exhibit 4-140: Estimated Annualized Incremental Cost per Household – High Scenario (2022 USD)

Funding	Source Water	Size	Mean	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Private	Ground	≤100	$64.60	$25.50	$35.50	$55.40	$87.40	$115.80
Private	Ground	100 to 500	$22.00	$4.60	$9.40	$18.70	$27.70	$46.80
Private	Ground	500 to 1,000	$4.80	$1.00	$1.50	$2.90	$6.50	$11.00
Private	Ground	1,000 to 3,300	$2.80	$0.50	$0.80	$1.50	$3.70	$5.20
Private	Ground	3,300 to 10,000	$11.20	-$1.70	$0.60	$6.20	$19.50	$34.00
Private	Ground	10,000 to 50,000	$8.90	$0.10	$0.50	$8.00	$15.40	$20.40
Private	Ground	50,000 to 100,000	$10.60	$0.00	$0.10	$12.00	$16.70	$20.10
Private	Ground	100,000 to 1,000,000	$6.50	$0.00	$0.20	$6.10	$11.70	$13.80
Private	Surface	≤100	$57.20	$20.90	$29.90	$49.30	$79.90	$108.10
Private	Surface	100 to 500	$16.70	$2.60	$6.90	$13.30	$21.20	$35.10
Private	Surface	500 to 1,000	$4.40	$1.20	$1.80	$2.70	$5.60	$9.70
Private	Surface	1,000 to 3,300	$2.80	$0.50	$0.70	$1.20	$3.40	$5.20
Private	Surface	3,300 to 10,000	$12.50	-$0.50	$0.70	$7.10	$20.30	$36.60
Private	Surface	10,000 to 50,000	$7.50	$0.10	$0.60	$4.90	$13.10	$18.20
Private	Surface	50,000 to 100,000	$9.80	$0.00	$2.20	$10.90	$15.30	$19.40
Private	Surface	100,000 to 1,000,000	$8.00	$0.00	$0.10	$8.50	$14.00	$16.90
Private	Surface	Greater than 1,000,000	$2.50	$1.60	$1.60	$3.20	$3.20	$3.40
Public	Ground	≤100	$51.70	$22.20	$29.40	$44.40	$71.70	$92.10
Public	Ground	100 to 500	$15.00	$4.40	$6.40	$11.50	$18.80	$30.60
Public	Ground	500 to 1,000	$4.00	$1.20	$1.50	$2.50	$4.80	$8.20
Public	Ground	1,000 to 3,300	$2.30	$0.40	$0.70	$1.20	$2.70	$4.30
Public	Ground	3,300 to 10,000	$8.70	-$0.60	$0.50	$4.40	$15.00	$26.30
Public	Ground	10,000 to 50,000	$6.20	$0.10	$0.50	$5.70	$10.50	$14.40
Public	Ground	50,000 to 100,000	$7.30	$0.00	$1.50	$8.40	$11.70	$14.20

Funding	Source Water	Size	Mean	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Public	Ground	100,000 to 1,000,000	$7.20	$0.00	$2.00	$8.60	$11.00	$13.50
Public	Ground	Greater than 1,000,000	$0.80	$0.30	$0.30	$1.10	$1.10	$1.20
Public	Surface	≤100	$52.90	$19.40	$28.50	$50.30	$71.00	$90.50
Public	Surface	100 to 500	$12.60	$3.80	$5.40	$9.80	$15.80	$25.50
Public	Surface	500 to 1,000	$3.60	$1.10	$1.50	$2.30	$4.60	$7.60
Public	Surface	1,000 to 3,300	$2.20	$0.40	$0.60	$1.20	$2.60	$4.00
Public	Surface	3,300 to 10,000	$9.90	$0.10	$0.70	$5.80	$17.00	$27.90
Public	Surface	10,000 to 50,000	$7.00	$0.20	$0.60	$6.20	$11.70	$16.00
Public	Surface	50,000 to 100,000	$8.20	$0.00	$0.40	$9.00	$13.50	$16.70
Public	Surface	100,000 to 1,000,000	$9.10	$0.00	$0.60	$10.50	$14.10	$17.00
Public	Surface	Greater than 1,000,000	$3.20	$0.30	$0.80	$2.60	$3.30	$6.90

Acronyms: USD = United States dollar.

Notes: System Category rows are not included for system categories that contain zero systems. When evaluating the economic impacts on households, the EPA uses the estimated PWS cost of capital to discount future costs (not the 2 percent discount rate used to evaluate social costs and benefit) because this best represents the actual costs of compliance that water systems would incur over time. For more information on cost of capital, see Section 4.2.3.3.

4.4 Estimating State (Primacy Agency) Costs

For many of the water system activities described in Section 4.3, the 56 primacy agencies[141] (note: this document uses "States" to refer generally to primacy agencies) will incur costs in the form of burden (*i.e.*, hours) to provide oversight and review. The State burden is multiplied by the labor rate ($/hr), as presented in Chapter 3, Section 3.3.11.2 to estimate labor unit costs. The remainder of this section mirrors that of Section 4.3 and is organized as follows:

- 4.4.1: State Implementation and Administrative Costs
- 4.4.2: State Sampling Related Costs
- 4.4.3: State CCT Related Costs
- 4.4.4: State Service Line Inventory and Replacement Related Costs
- 4.4.5: State POU Related Costs
- 4.4.6: State Public Education-Related Costs

Section 4.4.7 provides a summary of State costs affected by each major requirement for low and high cost scenarios at a 2 percent discount rate.

Exhibit 4-141 provides an overview of the rule components, subcomponents, and activities for which the EPA estimates State costs for the final LCRI. The derivation of unit burden is provided in each referenced subsection. At the end of each subsection, the EPA provides a summary exhibit showing the SafeWater LCR modeling approach for each State activity, as was done in Section 4.3 for PWSs. The SafeWater LCR model uses the information from these exhibits to calculate total annualized State cost for each activity. See Section 4.2 for detail on the cost modeling methodology.

As noted in Section 4.3, costs for State presented in this section are LCRI costs if no previous rule were in place. The national costs of the final LCRI, or incremental costs, are the difference between the cost of compliance with the final LCRI and the cost of compliance with the 2021 LCRR. These costs are presented in Exhibit 4-1 at the 2 percent discount rate.[142]

Also as discussed throughout Section 4.4, many of the inputs have been modified to include information provided by ASDWA in the February 20, 2020 version of their CoSTS model (ASDWA, 2020b) and/or in its

[141] The 56 primacy agencies include 49 States (excluding Wyoming), Puerto Rico, Guam, United States Virgin Islands, American Samoa, North Mariana Islands, and Navajo Nation. For cost modeling purposes, the EPA also included the District of Columbia (D.C.) as a primacy agency when assigning burden and costs of the rule although some of these costs are incurred by the actual primacy agency, EPA Region 3. Note that the EPA uses the "State" to denote "primacy agency" in this economic analysis.

[142] Note that the incremental national costs of the final LCRI when compared to the pre-2021 LCR have also been computed and are provided in Appendix C. Appendix B, Section B.9 explains how the EPA developed the cost values for the pre-2021 LCR, which were subtracted from the final LCRI costs to produce the incremental cost of moving from the pre-2021 LCR to the final LCRI rule requirements.

January 31, 2024 CoSTS model.[143] Both models include estimates of burden and/or cost to implement the rule requirements based on the final 2021 LCRR for 49 States excluding Wyoming.

Exhibit 4-141: State Cost Components, Subcomponents, and Activities Organized by Section[1]

Component	Subcomponents	Activities[2]
4.4.1: State Implementation and Administrative Costs	4.4.1.1: State Start-up Implementation and Administrative Activities	a) Adopt rule and develop program. b) Modify data management systems. c) Provide system training and technical assistance. d) Provide staff training. e) Review and approve small system flexibility option.
	4.4.1.2: State Annual Implementation and Administrative Activities	f) Coordinate with the EPA. g) Provide ongoing technical assistance. h) Report to SDWIS/Fed. i) Train staff for annual administration.
4.4.2: State Sampling Related Costs	4.4.2.1: State Lead Tap Sampling Costs	a) Provide templates for revised sampling instructions and conduct review. b) Review updated sampling plan. c) Review initial lead monitoring data and prepare systems for status under the LCRI. d) Review change in tap sample locations. e) Review 9-year monitoring waiver renewal. f) Review sample invalidation requests. g) Review consumer notification certifications. h) Review monitoring results and 90^{th} percentile calculations.
	4.4.2.2: State Lead WQP Sampling Costs	i) Review lead WQP sampling data and compliance with OWQPs.
	4.4.2.3: State Copper WQP Monitoring Costs	j) Review copper WQP sampling data and compliance with OWQPs.
	4.4.2.4: State Source Water Monitoring Costs	k) Review source water monitoring results.

143 ASDWA developed a model to estimate the increase in costs to States to implement the final 2021 LCRR requirements, which they provided to the EPA as part of the public comment process on the proposed rulemaking (referred to as the ASDWA 2020 CoSTS model) (ASDWA, 2020b). ASDWA prepared a similar model for the proposed LCRI, which they included as part of their public comments on the proposed rule (ASDWA, 2024). ASDWA subsequently provided slight modifications to their 2024 model in an email from ASDWA on April 19, 2024 to the EPA. The EPA uses the term "ASDWA 2024 CoSTS model" to refer to the revised version of model. Copies of the 2020 and 2024 models are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

Component	Subcomponents	Activities[2]
	4.4.2.5: State School Sampling Costs	l) Review list of schools and child care facilities. m) Provide templates on school and child care facility testing program. n) Review school and child care facility testing program materials. o) Review school and child care facility sampling results after individual sampling events. p) Review annual reports on school and child care facility lead in drinking water testing program.
4.4.3: State CCT Related Costs	4.4.3.1: CCT Installation	a) Review CCT study and determine type of CCT to be installed. b) Set OWQPs after CCT installation.
	4.4.3.2: Re-optimization	c) Review CCT study and determine needed OCCT adjustment. d) Reset OWQPs after CCT re-optimization.
	4.4.3.3: State DSSA Costs	e) Consult with system prior to any DSSA CCT adjustments. f) Review report on DSSA responses.
	4.4.3.4: State Lead CCT Routine Costs	g) Review CCT guidance and applicability to individual PWSs. h) Review water quality data with PWSs during sanitary survey. i) Consult on required actions in response to source water change. j) Consult on required actions in response to treatment change.
4.4.4: State Service Line Inventory and Replacement Related Costs	4.4.4.1: SL Inventory Costs	a) Review connector updated LCRR initial inventory (baseline inventory). b) Review annual service line inventory updates. c) Review inventory validation report.
	4.4.4.2: SLR Plan Review Costs	d) Review initial SLR plan. e) Review information on deferred deadline and associated replacement rate in the SLR plan and determine fastest feasible rate. f) Review annually updated SLR plan or certification of no change. g) Conduct triennial review of water system updated recommended deferred deadline and associated replacement rate and determine fastest feasible rate.
	4.4.4.3: SLR Report Review Costs	h) Review annual SLR program report.
4.4.5: State POU Related Costs	4.4.5.1: One-Time POU Program Costs	a) Review POU plan. b) Provide templates for POU outreach materials. c) Review POU public education materials.

Component	Subcomponents	Activities[2]
	4.4.5.2: Ongoing POU Program Costs	d) Review sample invalidation request for POU monitoring. e) Review customer notification certifications. f) Review annual POU program report.
4.4.6: State Public Education-Related Costs	4.4.6.1: Consumer Notice	a) Provide templates for consumer notice materials. b) Review lead consumer notice materials. c) Review copy of the consumer notice and certification.
	4.4.6.2: Activities Regardless of the Lead 90th Percentile Level	d) Provide templates for updated CCR language. e) Provide templates for local and State health department lead outreach. f) Review lead outreach materials for local and State health departments. g) Participate in joint communication efforts with local and State health departments. h) Provide templates for service line disturbance outreach materials. i) Review public education materials for service line disturbances. j) Provide templates for inventory-related outreach materials. k) Review inventory-related outreach materials. l) Provide technical assistance to PWSs for public education materials. m) Review public education certifications.
	4.4.6.3: Public Education Activities in Response to Lead ALE	n) Provide templates for updated public education materials for systems with a lead ALE. o) Review revised lead language for systems with a lead ALE. p) Consult with CWS on other public education activities in response to lead ALE.
4.4.6: State Public Education-Related Costs (continued)	4.4.6.4: Public Education Activities in Response to Multiple Lead ALEs	q) Review plan for making filters available. r) Provide templates for systems with multiple lead ALEs. s) Review outreach materials provided by systems with multiple lead ALEs. t) Consult on filter program for systems with multiple lead ALEs.

Acronyms: ALE = action level exceedance; CCR = Consumer Confidence Report; CCT = corrosion control treatment; CWS = community water system; DSSA = Distribution System and Site Assessment; LCRI = Lead and Copper Rule Improvements; OCCT = optimal corrosion control treatment; OWQPs = optimal water quality parameters; POU = point-of-use; PWS = public water system; SDWIS/Fed = Safe Drinking Water Act Information System/Federal version; SL = service line; SLR = service line replacement; WQP = water quality parameter.
Notes:

[1] States will also incur burden for recordkeeping activities under the final LCRI, such as retaining records of decisions, supporting documentation, technical basis for decisions, and documentation submitted by the system. The EPA has included burden for recordkeeping with each activity when applicable as opposed to providing separate burden estimates.
[2] The EPA assigned a unique letter of identification (ID) for each activity under a given rule component. Activities are generally organized with upfront, one-time activities first followed by ongoing activities. Note that these activities are different than the activities identified for PWSs in Exhibit 4-6.

4.4.1 State Implementation and Administrative Costs

States will incur both one-time and annual burden to implement and administer the new requirements. These one-time activities and associated SafeWater LCR model cost inputs are described in Sections 4.4.1.1. Ongoing activities and associated cost inputs are provided in Section 4.4.1.2. [144]

Note that State burden estimates for responding to specific requirements of the final LCRI (*e.g.,* review changes in a system's treatment, consult with systems, etc.) are presented in the sections for those particular rule requirements.

4.4.1.1 State Start-up Implementation and Administrative Activities

The EPA estimated that States will incur burden from conducting upfront, administrative activities to implement the final LCRI. These activities are not directly required by specific provisions of the final LCRI; however, they are necessary for States to ensure that the provisions are properly carried out.

The EPA has identified and developed costs for five start-up implementation and administration activities as shown in Exhibit 4-142. The last column provides the data variable used in the SafeWater LCR model in red/italic font. Each of these costs occur during Years 1 through 5 of the 35-year period of analysis. Additional assumptions related to each activity follow the exhibit. These burdens are based on the ASDWA 2020 and 2024 CoSTS models (ASDWA, 2020b; 2024).

[144] Also note that the EPA recognizes uncertainty in the burden estimates for State oversight and administration. As noted throughout this chapter, the EPA based several costing inputs on the ASDWA 2020 and/or 2024 CoSTS models. The EPA carefully reviewed both models and the proposed rule State burden estimates. In general, the EPA opted to use the more conservative, or higher, burden estimate among these relevant sources. Through this approach, the EPA intended to help account for additional LCRI State activities that are necessary for effective rule implementation and oversight but not required by the final rule and, therefore, not explicitly included in the SafeWater LCR cost model. With this strategy the agency has captured some portion of the additional State burden not directly associated with the regulatory requirements of the final LCRI but acknowledges that additional burden may still exist to the State programs. Further, ASDWA acknowledged in its comments to EPA on the proposed rule that its 2024 model may underestimate the dedicate staff time needed to handle calls from consumers, the media, and other State level staff resulting from the increase in the number of public notifications. If this is the case, then EPA's State cost estimates may also be underestimated.

Exhibit 4-142: State Administration Activities and Unit Burden Estimates (Occur during Years 1 through 5)

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Adopt rule and develop program	640 hrs/State	*hrs_adopt_rule_js*
b) Modify data management systems	740 hrs/State	*hrs_modify_ds_js*
c) Provide system training and technical assistance	800 hrs/State	*hrs_initial_ta_js*
d) Provide staff training	196 hrs/State	*hrs_train_imp_js*
e) Review and approve small system flexibility option	6 hrs per CWSs serving ≤3,300 and all NTNCWSs	*hrs_sm_flex_option_js*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Sources: ASDWA 2020 and 2024 CoSTS models (ASDWA, 2020b; 2024). Also see, "Administrative Burden and Costs_Final.xlsx" for more detailed information on deriving the estimated burden based on ASDWA's 2020 and 2024 CoSTS models.
Note: Costs occur during the first five years of rule implementation (Years 1 through 5) (ASDWA, 2020b; 2024). These costs apply to 49 States (excluding Wyoming), D.C, Puerto Rico, Guam, United States Virgin Islands, American Samoa, North Mariana Islands, and Navajo Nation

a) Adopt rule and develop program (hrs_adopt_rule_js). The EPA assumed States would incur a burden of 640 hours per year during Years 1 through 5 to adopt the rule that includes preparation of a primacy package and to develop their program for the LCRI. This estimate is based on ASDWA's projection in CoSTS, worksheet "Reg. Start-up" that State would require 3,200 hours over a 5-year period (ASDWA, 2020b; 2024). ASDWA's estimate remained the same in their 2024 CoSTS model.

b) Modify data management systems (hrs_modify_ds_js). The EPA assumed States will modify the data management system in-house and incur an annual burden of 740 hours for Years 1 through 5. This estimate is based on ASDWA's projection in CoSTS, worksheet "Reg. Start-up" that State would require 3,700 hours over a 5-year period (ASDWA, 2020b; 2024). ASDWA's estimates remained the same in their 2024 CoSTS model.

c) Provide system training and technical assistance (hrs_initial_ta_js). The EPA assumed States would incur an annual burden of 800 hours per year during Years 1 through 5 to provide initial system training and technical assistance related to the LCRI. This estimate is based on ASDWA's projection in CoSTS, worksheet "Reg. Start-up" that State would require 4,000 hours over a 5-year period (ASDWA, 2020b; 2024). ASDWA's estimates remained the same in their 2024 CoSTS model.

d) Provide staff training (hrs_train_imp_js). In CoSTS, worksheet "Reg. Start-up," ASDWA provided the estimated burden for States to provide four types of staff training on the proposed 2021 LCRR and proposed LCRI related to: 1) LSL inventories and replacement, 2) CCT, 3) public education, and 4) sampling and simultaneous compliance (ASDWA, 2020b; 2024). ASDWA developed different burden estimates for this training burden for different State sizes, as shown in Exhibit 4-143. The EPA used the weighted average divided over a 5-year period of 196 hours as the proposed LCRI burden for each of the States included in the SafeWater LCR model would incur during Years 1 through 5. ASDWA's estimates remained the same in their 2024 CoSTS model.

Exhibit 4-143: Estimated Burden for States to Provide Staff Training during Years 1 through 5

State Size	# of States	Burden per State
Large	9	2,000
Medium	20	1,000
Small	20	500
Weighted Average		980
5-year weighted average		**196**

Sources: ASDWA, 2020b; 2024, worksheet Reg. Start-Up.
Note: The EPA assumed the four types of training would occur over a 5-year period.

e) ***Review and approve small system flexibility option (hrs_sm_flex_option_js).*** States will incur burden to review and approve the compliance option recommended by CWSs serving 3,300 or fewer and all NTNCWSs that exceed the lead AL, which is assumed to occur in Year 4 of the 35-year analysis period. The EPA assumed a burden of 6 hours based on the burden for States to review and track a system's selected compliance option from the ASDWA 2024 CosTS model, section "Small System Flexibility"(ASDWA, 2024). This is an increase from 5 hours used in the proposed rule EA (USEPA, 2023c) that was based on the ASDWA 2020 CoSTS model (ASDWA, 2020b).

4.4.1.2 State Annual Implementation and Administrative Activities

In addition to one-time, upfront activities, States will incur burden to conduct annual activities to administer the LCRI. The EPA has identified and developed costs for four annual administration activities as shown in Exhibit 4-144. The exhibit provides the unit burden estimate for each activity and additional burden for new SDWIS/Fed reporting requirements under the LCRI. The last column provides the corresponding SafeWater LCR model data variable. A more detailed explanation of how the EPA derived the inputs are provided in text that follows the exhibit.

Exhibit 4-144: State Annual Administration Activities and Unit Burden Estimates

Activity	Unit Burden (hours/State)	*SafeWater LCR Data Variable*
f) Coordinate with the EPA	1,040	*hrs_coord_epa_js*
g) Provide ongoing technical assistance	2,367	*hrs_ta_js*
h) Report to SDWIS/Fed	1,560	*hrs_sdwis_js*
i) Train staff for annual administration	104	*hrs_train_ann_js*
Per State Total	5,071	

Sources:
f), h), and i): "Administrative Burden and Costs_Final.xlsx." Unit burdens are based on implementation burden estimated for the EPA's 2012, *Economic Analysis for the Final Revised Total Coliform Rule*, Exhibit 7.4, available in the docket.
g): ASDWA 2020 and 2024 CoSTS models (ASDWA, 2020b; 2024) and "Administrative Burden and Costs_Final.xlsx."

f) ***Coordinate with the EPA (hrs_coord_epa_js).*** States must coordinate with their particular EPA Regional office to be certain that their program is consistent with federal requirements. The EPA

estimated an annual burden of 1,040 hours based on the *Economic Analysis for the Final Revised Total Coliform Rule*, Exhibit 7.4 (USEPA, 2012a). ASDWA agreed with this estimate in their 2024 CoSTS model (ASDWA, 2024).

g) Provide ongoing technical assistance (hrs_ta_js). The EPA determined the on-going tracking and follow-up per system estimates provided in the ASDWA 2020 and 2024 CoSTS models (ASDWA, 2020b; 2024) for LSL inventory and replacement, tap sampling, sample site assessment, public notification and public education, and lead testing in schools and child care facilities as follows:

1. Determined the per system burden estimates separately for 12 categories that included small, medium, and large CWSs with and without lead and GRR service lines and the same categories for NTNCWSs because the estimates and rule applicability vary by system size, system type, LSL/GRR service line status.
2. Multiplied the per system estimate by the number of systems in each of the 12 categories based on the system inventory information provided in Chapter 3.
3. Summed the burden for the four system type and LSL/GRR service line status categories[145] to derive a total burden by size category.
4. Divided each burden by the 49 States used in the ASDWA CoSTS model to derive a total burden by size category.
5. Determined the weighted average across the size categories.
6. Divided the burden in step 5 by five because the estimates are provided for a 5-year period.

In determining the per system burden estimates, the EPA reviewed both the ASDWA 2020 and 2024 CoSTS models. In the instances where the burdens differed between the ASDWA 2020 CoSTS and ASDWA 2024 CoSTS models, the EPA used the higher of the two to provide a more conservative estimate. Note that the EPA did not include ASDWA's estimates for reporting or re-evaluation activities in the ongoing technical assistance burden because they are included in other data variables, violations, nor compliance estimates because the EPA assumed full compliance for cost modeling purposes. Also, the ongoing technical assistance burden does not include estimates from the "TL" or "CCT" worksheets because they are one-time activities and the EPA has accounted for their burden in other activities.[146]

h) Report to SDWIS/Fed (hrs_sdwis_js). The EPA assumed States will require 1,000 hours to meet the requirements of the pre-2021 LCR and an additional burden of 560 hours (or 0.25 full time equivalents) to meet the additional requirement for the LCRI for a total annual burden of 1,560 hours. The EPA is proposing to modify the reporting requirements under the LCRI. Specifically, the EPA is proposing to require States to report to SDWIS/Fed for each water system:

[145] The EPA split CWSs and NTNCWSs into those with LSLs, GRR, and unknown service lines versus those will all non-lead based on estimates from the 7th DWINSA. See Chapter 3, Section 3.3.4 for additional details.

[146] TL refers to the burden needed to review a system's latest rounds of compliance monitoring to determine their requirements under the 2021 LCRR. The TL does not apply under the proposed LCRI, but States will incur burden to review the system's latest rounds of compliance monitoring using input *hrs_initial_tap_rev_js* that is described in Section 4.4.2.1 activity c).

- The number of lead, GRR, and lead status unknown service lines and the number of lead connectors and non-lead service lines.
- The number and type of service lines replaced and the cumulative average replacement rate calculation.
- The 90th percentile lead level if it is above the AL within 15 days following the end of each applicable tap monitoring period or within 24 hours of receiving notification of an ALE from a water system, whichever is earlier.
- The completion date for systems on a deferred deadline and an explanation why a faster rate is not feasible.

The EPA based the burden estimate on the *Economic Analysis for the Final Revised Total Coliform Rule*, Exhibit 7.4 (USEPA, 2012a). ASDWA agreed with this estimate in their 2024 CoSTS model (ASDWA, 2024).

i) ***Train staff for annual administration (hrs_train_ann_js).*** The EPA assumed States will incur annual burden to continue to train staff related to annual administration. The EPA estimated an annual burden of 104 hours based on the *Economic Analysis for the Final Revised Total Coliform Rule*, Exhibit 7.4 (USEPA, 2012a). ASDWA agreed with this estimate in the 2024 CoSTS model (ASDWA, 2024).

Exhibit 4-145 provides details on how costs are calculated for State administrative and rule implementation activities a) through i) including additional cost inputs that are required to calculate these costs.

Exhibit 4-145: State Administration and Rule Implementation Cost Estimation in SafeWater LCR (by Activity)[1]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
a) Adopt rule and develop program				
The hours per State multiplied by the State labor rate. *(hrs_adopt_rule_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States	Annually for first 5 years
b) Modify data management systems				
The hours per State multiplied by the State labor rate. *(hrs_modify_ds_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States	Annually for first 5 years
c) Provide system training and technical assistance				
The hours per State multiplied by the State labor rate. *(hrs_initial_ta_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States	Annually for first 5 years

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
d) Provide staff training				
The hours per State multiplied by the State labor rate. *(hrs_train_imp_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States	Annually for first 5 years
e) Review and approve small system flexibility option[2]				
The hours per system multiplied by the State labor rate. *(hrs_sm_flex_option_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	CWSs without CCT serving ≤ 10,000 and NTNCWSs[2]	One time
f) Coordinate with the EPA				
The hours per State multiplied by the State labor rate. *(hrs_coord_epa_js*rate_js)*	Cost does not apply as written to States for NTNCWSs.	All	All States	Annually
g) Provide ongoing technical assistance				
The hours per State multiplied by the State labor rate. *(hrs_ta_js*rate_js)*	Cost does not apply as written to States for NTNCWSs.	All	All States	Annually
h) Report to SDWIS/Fed				
The hours per State multiplied by the State labor rate. *(hrs_sdwis_js*rate_js)*	Cost does not apply as written to States for NTNCWSs.	All	All States	Annually
i) Train staff for annual administration				
The hours per State multiplied by the State labor rate. *(hrs_train_ann_js*rate_js)*	Cost does not apply as written to States for NTNCWSs.	All	All States	Annually

Acronyms: CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system.

Notes:

[1] Costs are applied per State as opposed per system. The data variables in the exhibit are defined previously in Section 4.4.1 with the exception of:

- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

[2] Applies to CWSs serving ≤ 3,300 people and all NTNCWSs that exceed the AL.

4.4.2 State Sampling Related Costs

This section provides State unit burden related to lead tap sampling, lead WQP monitoring, copper WQP monitoring, source water monitoring, and school testing in Sections 4.4.2.1 through 4.4.2.5, respectively. As noted in Subsections 4.4.2.1, 4.4.2.4, and 4.4.2.5, as well as Section 4.4.5 that pertains to the POU program and Section 4.3.4.4 that pertains to SLR, five States incur the cost of bottles,

analysis, and providing lead sample results to the system (ASDWA, 2020a). In addition, six States also incur the burden and cost to update lead tap sampling instructions (see Sections 4.3.2.1.2 and 4.4.2.1). Note that there may be additional State laboratories that incur some analytical and reporting burden and costs in lieu of the system that would result in an underestimation of State costs.

4.4.2.1 State Lead Tap Sampling Costs

The EPA has identified and developed costs for eight State oversight and review activities associated with lead tap sampling conducted by water systems as shown in Exhibit 4-146. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-146: State Lead Tap Sampling Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Provide templates for revised sampling instructions and conduct review (one-time)	0.75 to 1 hr/PWS	*hrs_rev_samp_js*[1]
b) Review updated sampling plan	PWSs without LSLs 2 to 4 hrs/PWS PWSs with LSLs 4 to 10 hrs/PWS	*hrs_rev_samp_plan_js*
c) Review initial lead monitoring data and prepare systems for status under LCRI	2 to 4 hrs/PWS	*hrs_initial_tap_rev_js*
d) Review change in tap sample locations [2]	2 hrs/CWS	*hrs_chng_tap_js*
e) Review 9-year monitoring waiver renewal	0.5 hrs/PWS for those with 9-year monitoring waiver	*hrs_renew_nine_js*
f) Review sample invalidation requests	2 hrs/invalidation request	*hrs_samp_invalid_js*
g) Review consumer notification certifications	0.33 to 0.5 hrs/certification	*hrs_cert_cust_lt_js*
h) Review monitoring results and 90th percentile calculations[3]	PWSs without LSLs 0.5 to 2 hrs/PWS PWSs with LSLs 0.63 to 2.5 hrs/PWS	*hrs_annual_lt_js*

Acronyms: CWS = community water system; LCRR = Lead and Copper Rule revisions; LSL = lead service line; PWS = public water system.
Source: "Lead Analytical Burden and Costs_Final.xlsx."
Notes:
[1] As previously discussed in Section 4.3.2.1.2, in Arkansas, Louisiana, Mississippi, Missouri, North Dakota, and South Carolina the State sends sampling instructions to the water systems and thus are assumed to incur the burden to update the sampling instruction in lieu of the system (ASDWA, 2020a).
[2] Applies to CWSs only. The EPA assumed 0 hours for NTNCWSs because they collect their own samples from sampling locations under their control and thus, are unlikely to change sampling sites and submit documentation to the State for review.

[3] As previously discussed in Section 4.3.2.1.2, in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles, analysis, and providing sample results to the system (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities in lieu of the system. In this instance, the system burden to provide monitoring results and 90th percentile calculations is applied to these States and *hrs_annual_lt_js* would be 0. Instead, they will incur the system burden of *hrs_annual_lt_op* (see 4.3.2.1.2, activity p)).

a) ***Provide templates for revised sampling instructions and conduct review (hrs_rev_samp_js).*** All CWSs and NTNCWSs must update their sampling instructions to be consistent with updated tap sampling procedures. Systems are assumed to use an EPA template provided by the State as the basis for this update***.*** The EPA estimates States will incur a one-time burden per system of 0.75 hours to 1 hour to provide each water system with the template and to review the system's updated sampling instructions. This estimate is based on responses provided by North Carolina and Indiana of 0.25 and 0.5 hours, respectively, on the estimated time needed to update sampling instructions based on a template. The EPA used this estimate as the hours needed to provide the templates to the water systems. The EPA also assumed the States would not be reviewing extensive changes to the sampling instructions and would require 0.5 hours on average for this review.

b) ***Review updated sampling plan (hrs_rev_samp_plan_js).*** All CWSs and NTNCWSs must submit a sampling plan to the State under the final LCRI. States will incur a one-time burden to review the sampling plans submitted by all systems. The EPA estimated States will require 2 hours, 3 hours, and 4 hours for systems without LSLs serving 3,300 or fewer people; 3,301 to 100,000 people; and more than 100,000 people, respectively. The EPA assumed States will incur a higher burden for reviewing sampling plans for systems with LSLs of 4 hours, 8 hours, and 10 hours for systems serving 3,300 or fewer people; 3,301 to 100,000 people; and more than 100,000 people, respectively. The estimates for this input are based on the ASDWA 2020 CoSTS model, section "Tap Sampling" (ASDWA, 2020b). The EPA did not use ASDWA's size categories for medium and large systems, which are systems serving 3,301-50,000 and systems serving more than 50,000 people, respectively. The EPA intentionally applied the burdens for large systems to those serving more than 100,000 people because of the difference in the number of required samples compared to systems serving 100,000 or fewer people.[147] Further, the EPA also did not use estimates from the ASDWA 2024 CoSTS model to be more conservative because estimates in the 2020 model were lower.

c) ***Review initial lead monitoring data and prepare systems for status under the LCRI (hrs_initial_tap_rev_js).*** The EPA estimates States incur a one-time upfront burden per system to review their latest two rounds of compliance monitoring data to determine the system's status under the rule and prepare it for any new requirements. The EPA estimated States will require 2 hours, 3 hours, and 4 hours for small, medium, and large systems to review the information based on the ASDWA 2024 CoSTS model, section "Tap Sampling" (ASDWA, 2024), which the EPA assumed to be systems serving 3,300 or fewer people; 3,301 to 50,000 people; and more than 50,000 people, respectively. These estimates were increased from 2.1 hours per system in the proposed LCRI EA. The EPA used ASDWA 2024 CoSTS model estimates because they are more conservative than the proposed rule estimates.

[147] As shown in Exhibit 4-9, the minimum required number of samples for a system on standard monitoring is 100 for those serving more than 100,000 people compared to 60 samples for those serving 10,001 to 100,000 people.

d) Review change in tap sample locations (hrs_chng_tap_js). The EPA estimates States will spend 2 hours per CWS to review reported changes in tap sample locations and other updates to sampling plans between monitoring periods, starting in Year 5. The burden estimate is based on that provided in the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 48 (Move Tap Sampling Location) (USEPA, 2022a). This estimate was doubled from the proposed rule based on the ASDWA 2024 CoSTS model, section “Tap Sampling” (ASDWA, 2024), to be more conservative and to include the review of other updates to sampling plans. The EPA assumed this review to be negligible for NTNCWSs because they collect their own samples from sampling locations under their control and thus, are unlikely to change sampling sites and submit documentation to the State for review. Note that this assumption would underestimate burden in those instances in which a NTNCWS had to change sampling sites (*e.g.*, the site no longer meets the tiering criteria because the LSL was removed). However, the EPA anticipates that once all LSLs are removed, a NTNCWS’ sampling plan would remain fairly static. The EPA also assumed that a CWS’ sampling locations are more likely to change than a NTNCWS’ due a turnover in customer participation.

e) Review 9-year monitoring waiver renewal (hrs_renew_nine_js). The EPA estimated States will require 0.5 hours per CWS or NTNCWS on a 9-year tap monitoring schedule to review its 9-year monitoring waiver renewal request.[148] This estimate is based on the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 48 (Monitoring Waiver Application) (USEPA, 2022a).

f) Review sample invalidation requests (hrs_samp_invalid_js). The EPA estimated that States will incur 2 hours per sample invalidation request from a CWS or NTNCWS based on Indiana’s estimate of 2 hours to review this request in response to a 2016 ASDWA questionnaire. As discussed in 4.3.2.1.2, activity f), the EPA estimates that 0.6 percent of samples will be invalidated annually (*pp_samp_invalid*). ASDWA agreed with this estimate in their 2024 CoSTS model (ASDWA, 2024).

g) Review consumer notification certifications (hrs_cert_cust_lt_js). The EPA estimated States will require 0.33 hours to 0.5 hours to review each CWS or NTNCWS’s certification that monitoring results were reported to the consumer based on North Carolina and Indiana’s estimates for this review, respectively, in response to a 2016 ASDWA questionnaire. The questionnaire and each State’s responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

h) Review monitoring results and 90th percentile calculations (hrs_annual_lt_js). The EPA estimated the burden for States to review monitoring results and lead 90th percentile calculations. This information is provided in Exhibit 4-147 for States to review information submitted by CWSs and NTNCWSs with and without LSLs with more detailed assumptions provided in the exhibit notes. The EPA doubled these estimates from those used for the proposed LCRI EA to be more conservative and to better align the estimates with the higher estimates provided in the ASDWA 2024 CoSTS model, section “Tap Sampling” (ASDWA, 2024). The EPA applied the ASDWA 2024 CoSTS model estimate for large systems (2 hrs) to large systems without LSLs, increasing the burden from 1 hour under the proposed rule. The EPA doubled the burden for all remaining system categories and

[148] Systems serving 3,300 or fewer can apply for 9-year waivers if they can demonstrate their entire system including all buildings they serve are free of lead and copper. However, the EPA assumed that only those systems serving 1,000 people or fewer will meet the waiver requirements. For the rationale, see Chapter 3, Section 3.3.7.1.

maintained the assumption from the proposed LCRI EA that the burden for systems with LSLs would be 25 percent higher than those without LSLs.

Exhibit 4-147: Burden to Review Lead Tap Sampling Results and 90th Percentile Level

System Size (Population Served)	Review Lead Tap Sampling Results and 90th Percentile Calculation (hrs/system/monitoring period)	
	hrs_annual_lt_js	
	A	**B=A*1.25**
	No LSL	**LSL**
≤3,300	0.5	0.63
3,301-10,000	1	1.25
10,001-100,000	1.5	1.88
> 100,000	2	2.5

Source: 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal)*, Exhibit 48 (Tap Sample Calcs) (USEPA, 2022a). These estimates were doubled in the final rule based on ASDWA's 2024 CoSTS model, section "Tap Sampling" (ASDWA, 2024).
Note: For systems with LSLs, the EPA assumed States would require an additional burden of 25 percent because LSLs systems must also provide documentation under the final LCRI if they are unable to collect all of their samples from LSL sites.

Exhibit 4-148 shows the SafeWater LCR model costing approach for these State lead tap sampling activities including additional cost inputs required to calculate these costs.

Exhibit 4-148: State Lead Tap Sampling Unit Cost Estimation in SafeWater LCR by Activity[1,2]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[2]	
a) Provide templates for revised sampling instructions and conduct review				
The hours per system multiplied by the State labor rate. *(hrs_rev_samp_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States	One time
b) Review updated sampling plan				
The hours per system multiplied by the State labor rate. *(hrs_rev_samp_plan_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States with model PWSs with LSLs	One time
c) Review initial lead monitoring data and prepare systems for status under the LCRI				
The hours per system multiplied by the State labor rate. *(hrs_initial_tap_rev_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States	One time
d) Review change in tap sampling locations				
The hours per system multiplied by the State labor rate. *(hrs_chng_tap_js*rate_js)*	Cost does not apply to States for NTNCWSs.	At or below AL	States with any model PWSs not on reduced tap sampling and not doing POU sampling 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
			States with any model PWSs on reduced annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[2]	
			States with any model PWSs on reduced triennial tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
The hours per system multiplied by the State labor rate. *(hrs_chng_tap_js*rate_js)*	Cost does not apply to States for NTNCWSs.	At or below AL	States with any model PWSs on reduced nine year sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		Above AL	States with any model PWSs not doing POU sampling	Twice a year
e) Review 9-year monitoring waiver renewal[3]				
The hours per system multiplied by the State labor rate. *(hrs_renew_nine_js*rate_js)*	Cost applies as written to States for NTNCWSs.	At or below AL[3]	States with any model PWSs on reduced nine-year sampling and not doing POU sampling *p_tap_nine*	Every 9 years
f) Review sample invalidation request				
The number of samples determined to be invalid multiplied by the hours per sample per system and the State labor rate. *(numb_samp_customer*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	Cost applies as written to States for NTNCWSs.	At or below AL	States with any model PWSs not on reduced tap sampling and not doing POU sampling 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[2]	
			States with any model PWSs on reduced annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
The number of samples determined to be invalid multiplied by the hours per sample per system and the State labor rate. *(numb_reduced_tap*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	Cost applies as written to States for NTNCWSs.	At or below AL	States with any model PWSs on reduced triennial tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			States with any model PWSs on reduced nine year sampling and not doing POU sampling *p_tap_nine*	Every 9 years
The number of samples determined to be invalid multiplied by the hours per sample per system and the State labor rate. *(numb_samp_customer*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with any model PWSs not doing POU sampling	Twice a year

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[2]	
g) Review consumer notification certifications				
The hours per system multiplied by the State labor rate. *(hrs_cert_cust_lt_js*rate_js)*	Cost applies as written to States for NTNCWSs.	At or below AL	States with any model PWSs not on reduced tap sampling and not doing POU sampling 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
			States with any model PWSs on reduced annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			States with any model PWSs on reduced triennial tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			States with any model PWSs on reduced nine year sampling and not doing POU sampling *p_tap_nine*	Every 9 years
		Above AL	States with any model PWSs not doing POU sampling	Twice a year

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[2]	
h) Review monitoring results and 90th percentile calculations[4]				
The hours per system multiplied by the State labor rate. *(hrs_annual_lt_js*rate_js)*	Cost applies as written to States for NTNCWSs.	At or below AL	States with any model PWSs not on reduced tap sampling and not doing POU sampling 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine)*	Twice a year
			States with any model PWSs on reduced annual tap sampling and not doing POU sampling *p_tap_annual*	Once a year
			States with any model PWSs on reduced triennial tap sampling and not doing POU sampling *p_tap_triennial*	Every 3 years
			States with any model PWSs on reduced nine year sampling and not doing POU sampling *p_tap_nine*	Every 9 years

Acronyms: AL = action level; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of the following:

- *numb_reduced_tap*: Number of tap samples for systems on reduced lead tap monitoring that include systems with lead 90th percentile values ≤ 10 µg/L and which are sampling less frequently than semi-annually (Section 4.3.2.1.1).
- *numb_samp_customer*: Number of tap samples for systems on standard lead tap monitoring that include some systems with 90th percentile values ≤ 10 µg/L and all systems > 10 µg/L (Section 4.3.2.1.1).
- *pp_samp_invalid*: Likelihood that a lead sample will be deemed invalid (Section 4.3.2.1.2, activity f)).
- *p_tap_annual* : Likelihood a system will qualify to collect the reduced number of lead tap samples at an annual frequency (Section 4.3.2.1.1).
- *p_tap_triennial*: Likelihood a system will qualify to collect the reduced number of lead tap samples at a triennial frequency (Section 4.3.2.1.1).
- *p_tap_nine*: Likelihood a system will qualify to collect the reduced number of lead tap samples at a nine-year frequency (Section 4.3.2.1.1).

- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

[2] Does not apply to CWSs serving ≤ 3,300 people and all NTNCWSs that have selected POU provision and maintenance as their compliance option if they exceeded the lead AL. See Section 4.3.5 for additional detail. PWSs with lead content or unknown lines are identified using the data variables and approach described in Chapter 3, Section 3.3.4.

[3] Only systems with 90th percentile values ≤ the AL of 10 µg/L can quality for a 9-year monitoring waiver.

[4] As previously discussed in Section 4.3.2.1.2, in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles, shipping, analysis, and providing sample results to the system (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities in lieu of the system. In this instance, the system burden to provide monitoring results and 90th percentile calculations is applied to these States and *hrs_annual_lt_js* would be 0. Instead, they will incur the system burden of *hrs_annual_lt_op* (see Section 4.3.2.1.2, activity p)).

4.4.2.2 State Lead WQP Sampling Costs

The EPA has developed State costs for the review of lead WQP monitoring data submitted by systems serving 50,000 or fewer people with a lead ALE and all systems serving more than 10,000 people with CCT,[149] as shown in Exhibit 4-149. The exhibit provides the unit burden. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-149: State Lead WQP Monitoring Burden Estimates

Activity	Unit Burden	***SafeWater LCR Data Variable***
i) Review lead WQP sampling data and compliance with OWQPs	No CCT: 5 hrs/system/6-month monitoring period; With CCT: 8.5 hrs/system/6-month monitoring period	*hrs_wqp_js*

Acronyms: CCT = corrosion control treatment; OWQP = optimal water quality parameter; WQP = water quality parameter.
Source: "WQP Analytical Burden and Costs_Final.xlsx."

i) Review lead WQP sampling data and compliance with OWQPs (hrs_wqp_js). States will review a system's WQP monitoring data collected from entry points and within the distribution system. The EPA assumed States will incur a burden of 5 hours per system during each 6-month monitoring period for systems without CCT. This estimate is based on the average of responses provided by North Carolina and Indiana to a 2016 ASDWA survey question regarding the hours to review WQP monitoring data of 6 and 4 hours, respectively. A copy of the questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801. The EPA assumed States will set OWQPs for all systems with CCT and will incur an additional 3.5 hours per 6-month monitoring period to review compliance with OWQPs for a total of 8.5 hours.

Exhibit 4-150 shows the SafeWater LCR model costing approach for this State lead WQP monitoring activity. As shown in the exhibit, the SafeWater LCR model relies upon additional inputs, such the likelihood a system has a certain type of CCT in place, to estimate total costs. A description of the data variables and section where they are described in more detail are provided in the footnote to the exhibit.

[149] All systems serving more than 50,000 people except those with naturally non-corrosive water (*i.e.*, "b3" systems) are required to have CCT. Also, the LCRI strengthens the requirements for CWSs serving 10,001 to 50,000 with CCT to require them to continue to conduct WQP monitoring regardless of the lead or copper AL. Previously, these systems were only required to conduct WQP monitoring during the monitoring periods in which they had a lead or copper ALE, unless required by the State.

Exhibit 4-150: State Lead WQP Monitoring Cost Estimation in SafeWater LCR by Activity[1]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
i) Review lead WQP sampling data and compliance with OWQPs				
The hours per system multiplied by the State labor rate. *(hrs_wqp_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with any PWSs serving ≤50,000 and without CCT	Twice a year
			States with any PWSs serving ≤10,000 and having pH adjustment in place *pbaseph*	
			States with any PWSs serving ≤10,000 and having PO_4 or both PO_4 and pH adjustment in place *pbasepo4, pbasephpo4*	
		All	States with any PWSs serving >10,000 and having pH adjustment in place *pbaseph*	
			States with any PWSs serving >10,000 and having PO_4 or both PO_4 and pH adjustment in place *pbasepo4, pbasephpo4*	

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; OWQP = optimal water quality parameter; PO_4 = orthophosphate; PWS = public water system; WQP = water quality parameter.

Notes:

The data variables in the exhibit are defined previously in this section with the exception of:

- *pbaseph*, *pbasepo4, and pbasephpo4:* Likelihood system has pH adjustment, orthophosphate, or pH adjustment and orthophosphate for their CCT (Section 4.3.2.2.1).
- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

4.4.2.3 State Copper WQP Monitoring Costs

The EPA has developed State costs for the review of copper WQP monitoring data per 6-month monitoring period as shown in Exhibit 4-151. The exhibit provides the unit burden. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. Note that the data variable is the same as for reviewing lead WQP data.

Exhibit 4-151: State Copper WQP Monitoring Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
j) Review copper WQP sampling data and compliance with OWQPs	No CCT: 5 hrs/system/6 month monitoring period; With CCT: 8.5 hrs/system/6 month monitoring period	*hrs_wqp_js*

Acronyms: CCT = corrosion control treatment; OWQP = optimal water quality parameter; WQP = water quality parameter.
Source: "WQP Analytica Burden and Costs_Final.xlsx."

j) Review copper WQP sampling data and compliance with OWQPs (hrs_wqp_js). As stated in Section 4.3.2.3, the SafeWater LCR models copper WQP monitoring separately from lead WQP monitoring to avoid double counting the cost of WQP monitoring for systems experiencing a copper ALE and a lead ALE simultaneously. The SafeWater LCR model restricts copper WQP monitoring to systems serving 50,000 or fewer people without CCT that do not exceed the lead AL but exceed the copper AL of 1.3 mg/L. See Exhibit 4-38 and Exhibit 4-39 in Section 4.3.2.3.1 for the likelihood a system has a copper only ALE (*p_copper_ale*)[150] for CWSs and NTNCWSs, respectively. The unit burden for States to review sampling data and compliance with OWQPs (*hrs_wqp_js*) is identical to that used for State Lead WQP Monitoring of 5 hours and 8.5 hours per system per 6-month monitoring period for systems without CCT and with CCT, respectively (see Section 4.4.2.2, activity i)).

Exhibit 4-152 shows the SafeWater LCR model costing approach for this State copper WQP monitoring activity. As shown in the exhibit, the SafeWater LCR model relies upon additional inputs that include the likelihood a system has a certain type of CCT in place and as discussed above, the likelihood a system has a copper ALE. A description of the data variables and section where they are described in more detail are provided in footnote 1 to the exhibit.

[150] As described in Section 4.3.2.3.1, the EPA assumed all systems with CCT would have sufficient CCT such that none would have a copper ALE. Because all systems serving 50,000 or more people have CCT (except for 16 "b3" systems), SafeWater LCR does not assign any copper WQP costs to systems serving more than 50,000 people.

Exhibit 4-152: State Copper WQP Monitoring Cost Estimation in SafeWater LCR by Activity[1]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
j) Review copper WQP sampling data and compliance with OWQPs				
The hours per system multiplied by the State labor rate. *(hrs_wqp_js*rate_js)*	Cost applies as written to States for NTNCWSs.	At or below AL	States with any model PWSs serving ≤50,000, without CCT, and having a copper ALE *p_copper_ale*	Twice a year
The hours per system multiplied by the State labor rate. *(hrs_wqp_js*rate_js)*	Cost applies as written to States for NTNCWSs.	At or below AL	States with any model PWSs serving >10,000, having pH adjustment in place, and having a copper ALE *p_copper_ale, pbaseph*	Twice a year
			States with any model PWSs serving >10,000, having PO_4 or both PO_4 and pH adjustment in place, and having a copper ALE *p_copper_ale, pbasepo4, pbasephpo4*	

Acronyms: AL = action level; ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; OWQP = optimal water quality parameter; PO_4 = orthophosphate; PWS = public water system; WQP = water quality parameter.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_copper_ale:* Likelihood that a system exceeds the copper AL but not the lead AL (Section 4.3.2.3.1).
- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

4.4.2.4 State Source Water Monitoring Costs

The EPA has developed State costs to review source water monitoring data as shown in Exhibit 4-153. The exhibit provides the unit burden. The assumptions used in the estimation of the unit burden following the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-153: State Source Monitoring Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
k) Review source water monitoring results	0.5 hrs/system/monitoring period in which source water samples are collected	*hrs_source_js*

Source: " Lead Analytical Burden and Costs_Final.xlsx," worksheet, "Source_Reporting_Review."
Notes: As previously discussed in Section 4.3.2.4.2 in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles, analysis, and providing sample results to the system (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities in lieu of the system. In these States, because the State is reporting the results, the burden to review the results (*hrs_source_js*) is 0. Instead, the system burden to report the results (*hrs_report_source_op*) is applied to these States (see Section 4.3.2.4.2, activity hh)).

- ***k) Review source water monitoring results (hrs_source_js).*** States will incur burden to review source water monitoring results submitted by water systems. The EPA estimates that the State will incur 0.5 hours per system per monitoring period in which the system conducts source water monitoring (*hrs_source_js*). The burden estimate is based on the State review burden for a source water monitoring letter in the 2022 *Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Rules ICR (Renewal),* Exhibit 48 (USEPA, 2022a).

Exhibit 4-154 details how the data variables are used to estimate State source water monitoring unit costs. As shown in the exhibit, the SafeWater LCR model relies upon additional inputs, such the likelihood a system has changed its source. A description of the data variables and section where they are described in more detail in the footnote 1 to the exhibit.

Exhibit 4-154: State Source Water Monitoring Cost Estimation in SafeWater LCR by Activity[1]

<table>
<tr><th rowspan="2">State Cost Per Activity for CWSs</th><th rowspan="2">State Cost Per Activity for NTNCWSs</th><th colspan="2">Conditions for Cost to Apply to a State</th><th rowspan="2">Frequency of Activity</th></tr>
<tr><th>Lead 90th – Range</th><th>Other Conditions</th></tr>
<tr><td colspan="5">k) Review source water monitoring results[2]</td></tr>
<tr><td rowspan="3">The hours per system multiplied by the State labor rate.

(hrs_source_js*rate_js)</td><td rowspan="3">Cost applies as written to States for NTNCWSs.</td><td>All</td><td>States with any model PWSs with a significant change in source water

p_source_sig * p_source_chng[3]</td><td>Once a year</td></tr>
<tr><td>At or below AL</td><td>States with any model PWSs with a copper ALE

p_copper_ale</td><td rowspan="2">One time</td></tr>
<tr><td>Above AL</td><td>All States with PWSs that have not conducted prior source water monitoring</td></tr>
</table>

Acronyms: AL = action level; ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_source_chng:* Likelihood a system will have a source change (Chapter 3, Section 3.3.9.1).
- *p_source_sig:* Likelihood that the system will have a significant change in which it changes its primary source, e.g., for ground water to surface water (Chapter 3, Section 3.3.9.2).
- *p_copper_ale:* Likelihood that a system exceeds the copper AL but not the lead AL (Section 4.3.2.3.1).
- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

[2] As previously discussed in Section 4.3.2.4.2 in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles, shipping, analysis, and providing sample results to the system (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities in lieu of the system. In these States, because the State is reporting the results, the burden to review the results (*hrs_source_js*) is 0. Instead, the system burden to report the results (*hrs_report_source_op*) is applied to these States (see Section 4.3.2.4.2, activity hh)).

[3] The likelihoods of *p_source_chng* and *p_source_sig* are multiplied to determine the joint likelihood that a system that makes a source change will be required to take additional action such as source water monitoring.

4.4.2.5 State School Sampling Costs

The EPA has developed burden for one-time State activities for oversight of CWSs' lead in drinking water testing programs at schools and child care facilities as shown in Exhibit 4-155. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font. Note that the one-time activities are assumed to occur in Year 4 and the on-going activities to occur under the first and subsequent five-year testing cycles starting in Year 4 onward.

Exhibit 4-155: State School Sampling Burden Estimates

Activity	Unit Burden	***SafeWater LCR Data Variable***
l) Review list of schools and child care facilities (every 5 years starting in Year 4)	3 hrs/CWS	*hrs_rev_school_list_js*
m) Provide templates on school and child care facility testing program (one time)	0.25 to 0.5 hrs/CWS	*hrs_temp_school_js*
n) Review school and child care facility testing program materials (one time)	1 hr/CWS serving ≤ 50,000; 3 hrs/CWS serving > 50,000	*hrs_rev_school_info_js*
o) Review school and child care facility sampling results after individual sampling events	6 hrs/CWS/year	*hrs_sch_cc_results_review_js*
p) Review annual reports on school and child care facility lead in drinking water testing program	1 hr/CWS/year	*hrs_annual_report_school_js*

Acronyms: CWS = community water system.

Source: "School_Child Care Inputs_Final.xlsx."

Note:

[1] As previously discussed in Section 4.3.2.5 in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles, shipping, and analyses associated with lead testing (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities under the testing program at schools and child care facilities.

l) ***Review list of schools and child care facilities (hrs_rev_school_list_js).*** The EPA estimated that States will review the initial list of schools and licensed child care facilities served by each CWS and the list updates every five years. The EPA assumed States will incur a burden of 3 hours per CWS per review based on the ASDWA 2020 CoSTS model, section "Lead Testing in Schools" (ASDWA, 2020b). The EPA did not use estimates from the ASDWA 2024 CoSTS model because they were less conservative than those provided in the 2020 model.

m) ***Provide templates on school and child care facility testing program (hrs_temp_school_js).*** CWSs must notify each school and child care facility they serve about the testing program. The EPA assumed States would provide a template to assist CWSs in developing these materials. The EPA assumed States would incur a similar burden to provide these templates as other outreach materials of 0.25 to 0.5 hours per system. The burden estimates are based on North Carolina and Indiana's response to a 2016 ASDWA survey regarding the burden to provide a sampling instruction template of 0.25 hours and 0.5 hours per template, respectively. The questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

n) ***Review school and child care facility testing program materials (hrs_rev_school_info_js).*** The EPA estimated that States will incur a one-time burden to review school and child care facility testing program materials. The EPA assumed CWSs serving 50,000 or fewer people will rely mainly on the template, and States will require 1 hour for review. The EPA assumed that systems serving more than 50,000 people will adapt the template and the States will require more time (3 hours) to review these materials. This estimate is based on the ASDWA 2024 CoSTS model (ASDWA, 2024). This is an increase in the burden that was used in the proposed LCRI EA of 0.5 and 2 hours for systems serving 50,000 or fewer people and more than 50,000 people, respectively.

o) ***Review school and child care facility sampling results after individual sampling events.*** Under the final LCRI, CWSs will be required to provide school and child care facility testing results to their State within 30 days of receiving the analytical results (*hrs_report_sch_cc_results_op*). The EPA assumed that CWSs will sample a portion of schools and child care facilities each month and would require 1 hour each month or 12 hours annually. The EPA estimated States will require half the burden (or 6 hours) per CWS per year to review the monitoring results as the burden required for a water system to prepare and email the sampling results.

p) ***Review annual reports on school and child care facility lead in drinking water testing program (hrs_annual_report_school_js).*** The EPA estimated States will require 1 hour per CWS to review the system's annual report (*hrs_annual_report_school_js*). This burden is based on the ASDWA 2020 CoSTS model, section "Lead Testing in Schools" (ASDWA, 2020b).[151] This may overestimate the burden in Years 14 onward because systems will likely be reporting on their testing program for fewer schools and child care facilities. Note that an estimate for this review was not explicitly included in the ASDWA 2024 CoSTS model.

[151] Refer to footnote 8.

Exhibit 4-156 provides details on how costs are calculated for State school and child care facility sampling-related costs including additional cost inputs that are required to calculate these costs.

Exhibit 4-156: State School and Child Care Facility Sampling Cost Estimation in SafeWater LCR by Activity[1,2]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
l) Review list of schools and child care facilities				
The hours per system multiplied by the State labor rate. *(hrs_rev_school_list_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States	Every five years
m) Provide templates on school and child care facility testing program				
The hours per system multiplied by the State labor rate. *(hrs_temp_school_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States	One time
n) Review school and child care facility testing program materials				
The hours per system multiplied by the State labor rate. *(hrs_rev_school_info_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States	One time
o) Review school and child care facility sampling results				
The hours per system multiplied by the State labor rate. *(hrs_sch_cc_results_review_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States	Once a year
p) Review annual reports on school and child care facility lead in drinking water testing program				
The hours per system multiplied by the State labor rate. *(hrs_annual_report_school_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States	Once a year

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of the following:

- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

[2] As previously discussed in Section 4.3.2.5 in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles, shipping, and analyses associated with lead testing (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities for the first and subsequent 5-year cycles of the testing program at schools and child care facilities.

4.4.3 State CCT Related Costs

State oversight and review activities related to CCT are grouped into four major subcomponents:

- CCT Installation
- Re-optimization
- Distribution System and Site Assessment
- Routine

Unit costs and modeling assumptions for each activity related to these four subcomponents are presented in Sections 4.4.3.1 through 4.4.3.4, respectively.

4.4.3.1 State CCT Installation Costs

The EPA has developed State cost for two one-time activities associated with CCT installation as shown in Exhibit 4-157. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variables in red/italic font.

Exhibit 4-157: State CCT Installation Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Review CCT study and determine type of CCT to be installed	27 to 52 hrs/system	*hrs_review_cct_study_lead_js*
b) Set OWQPs after CCT installation	2 to 12 hrs/system serving ≤ 50,000 people	*hrs_set_owqp_js*

Acronyms: CCT = corrosion control treatment; LSL = lead service line; OWQP = optimal water quality parameter.
Source: a), b): "CCT Study and Review Costs_Final.xlsx."

a) Review CCT study and determine type of CCT to be installed (hrs_review_cct_study_lead_js). States will incur burden to review a system's CCT study. The EPA based the estimated burden on those provided in the ASDWA 2024 CoSTS model, section "CCT" (ASDWA, 2024). For the proposed LCRI EA (USEPA, 2023c), the estimated burden was based on responses from North Carolina to a 2016 questionnaire provided by ASDWA (available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov) and included different estimates for systems with and without LSLs. Exhibit 4-158 provides the data variable and input values associated with this activity.

Exhibit 4-158: Estimated Burden for States to Review Initial CCT Study

System Size (Population Served)	Review CCT Study Report (hrs/system) *(hrs_review_cct_study_lead_js)*
≤ 500	27
501-3,300	27
3,301-10,000	52

System Size (Population Served)	Review CCT Study Report (hrs/system) *(hrs_review_cct_study_lead_js)*
10,001-50,000	52
>50,000	N/A

Acronyms: CCT = corrosion control treatment.
Source: "CCT Study and Review Costs_Final.xlsx;" ASDWA, 2024.
Notes:
With the exception of b3 systems, serving > 50,000 people were already required to conduct a CCT study and install CCT under the LCR.

b) ***Set OWQPs after CCT installation (hrs_set_owqp_js).*** The EPA assumed that States will incur burden to set OWQPs after systems install CCT. The EPA based its estimate on responses from North Carolina to a 2016 questionnaire provided by ASDWA. The questionnaire and North Carolina's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov. Exhibit 4-159 provides the data variable and input values associated with this activity and detailed assumptions in the notes.

Exhibit 4-159: Estimated Burden for State Review to Set OWQPs

System Size (Population Served)	Set OWQPs[1] *(hrs_set_owqp_js)*
≤500	2
501-3,300	5
3,301-50,000	12
>50,000[2]	N/A

Acronyms: OWQP = optimal water quality parameters.
Source: "CCT Study and Review Costs_Final.xlsx."
Notes:
[1] In response to a 2016 ASDWA questionnaire (docket EPA-OW-HQ-2022-0801 at www.regulations.gov), North Carolina estimated a burden of 2 hours for systems serving ≤ 500 people to 12 hours for systems serving 10,001 to 50,000 people to set OWQPs. The EPA assumed a burden within this range of 5 hours for those serving 501 to 3,300 people and 12 hours for those serving 3,301 to 10,000 people.
[2] With the exception of "b3" systems, serving > 50,000 people were already required to conduct a CCT study and install CCT under the LCR and States would have already set OWQPs.

Exhibit 4-160 provides the SafeWater LCR model costing approach for the two State activities related to CCT Installation including additional cost inputs that are required to calculate total costs.

Exhibit 4-160: State CCT Installation Cost Estimation in SafeWater LCR by Activity[1]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
a) Review CCT study and determine type of CCT to be installed				
The hours per system multiplied by the State labor rate. *(hrs_review_cct_study_lead_js* rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with any model PWSs without CCT conducting a study on the installation of CCT	One time
b) Set OWQPs after CCT installation				
The hours per system multiplied by the State labor rate. *(hrs_set_owqp_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with any model PWSs installing CCT	One time

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

4.4.3.2 State CCT Re-optimization Costs

The EPA has identified and developed State costs for two oversight and review activities associated with a system's re-optimization of existing CCT, as shown in Exhibit 4-161. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-161: State CCT Re-Optimization-Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
c) Review CCT study and determine needed OCCT adjustment	28 to 50 hrs/system	*hrs_review_cct_study_lead_js*
d) Reset OWQPs after CCT re-optimization	2 to 20 hrs/system	*hrs_reset_owqp_js*

Acronyms: CCT = corrosion control treatment; LSL = lead service line; OWQP = optimal water quality parameter.
Source: "CCT Study and Review Costs_Final.xlsx."

c) Review CCT study and determine needed OCCT adjustment (hrs_review_cct_study_lead_js). States will incur burden to review the revised CCT study for PWSs with existing CCT when they exceed the AL. The EPA based its estimates on those provided in the ASDWA 2024 CoSTS model, section "CCT" (ASDWA, 2024). For the proposed LCRI EA (USEPA, 2023c), the EPA based the burden estimates on

responses from North Carolina to a 2016 questionnaire provided by ASDWA (available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov) and included different estimates for systems with and without LSLs. The estimated burden to review a revised study is provided in Exhibit 4-162.

Exhibit 4-162: Estimated Burden for States to Review a Revised CCT Study and Determine Needed CCT Adjustment

System Size (Population Served)	Review Revised CCT Study Report (hrs/system) *(hrs_review_cct_study_lead_js)*
≤ 500	28
501-3,300	28
3,301-10,000	50
10,001-50,000	50
>50,000	50

Acronyms: CCT = corrosion control treatment.
Source: "CCT Study and Review Costs_Final.xlsx."

d) ***Reset OWQPs after CCT re-optimization hrs_reset_owqp_js).*** States will need to reset OWQPs after the system re-optimizes its CCT. For systems serving 50,000 or fewer people, the EPA assumed this burden is the same as the burden to set OWQPs for the first time (2 to 12 hours, data variable *hrs_set_owqp_js* as presented in Exhibit 4-159). For systems serving more than 50,000 people, the EPA assumed a burden of 20 hours for States to reset OWQPs due to the larger size and relative complexities of these systems.

Exhibit 4-163 details how the data variables are used to estimate State activities related to CCT re-optimization including additional cost inputs that are required to calculate the total costs.

Exhibit 4-163: State CCT Re-optimization Cost Estimation in SafeWater LCR by Activity[1]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
c) Review CCT study and determine needed OCCT adjustment				
The hours per system multiplied by the State labor rate. *(hrs_review_cct_study_lead_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with model PWS conducting a study prior to re-optimizing CCT	One time
d) Reset OWQPs after CCT re-optimization				
The hours per system multiplied by the State labor rate. *(hrs_reset_owqp_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with model PWS re-optimizing CCT	One time

Acronyms: AL = action level**;** CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; OCCT = optimal corrosion control treatment; OWQP = optimal water quality parameters; PWS = public water system.

Notes:
[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

4.4.3.3 State Distribution System and Site Assessment Costs

The EPA developed State costs to related to DSSA activities as shown in Exhibit 4-164. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-164: State DSSA Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
e) Consult with system prior to any DSSA CCT adjustments	2 hrs per PWS	*hrs_consult_dssa_js*
f) Review report on DSSA responses	1 hr/PWS serving ≤ 50,000 people; 2 hrs/PWS serving > 50,000 people	*hrs_report_dssa_js*

Acronyms: CCT = corrosion control treatment; DSSA = Distribution System and Site Assessment; PWS = public water system.
Source: “Likelihood_Sample_Above_AL_LCRI_DSSA.xlsx.”

e) ***Consult with system prior to any DSSA CCT adjustment (hrs_consult_dssa_js).*** Systems with CCT that have at least one sample > 10 µg/L must consult with their State prior to making any CCT changes. The EPA assumed States will incur a 2 hour burden per system that is consistent with other types of consultations, *e.g.*, State consultation prior to a change in source or treatment.

f) ***Review report on DSSA responses (hrs_report_dssa_js).*** States will incur burden to review the system’s report that provides the results of tap and WQP monitoring, a distribution system assessment, and recommended corrective actions (*i.e.*, DSSA responses) if a system has one or more samples above 10 µg/L in a given year. The EPA assumed the State will require 1 hour and 2 hours to review the report submitted by systems serving 50,000 or fewer and those serving more than 50,000 people, respectively.

Exhibit 4-165 provides details on how total costs for the final LCRI are calculated for this activity including additional cost inputs that are required to calculate the total costs.

Exhibit 4-165: State CCT DSSA Cost Estimation in SafeWater LCR by Activity[1,2]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
e) Consult with system prior to any DSSA CCT adjustments				
The hours per system multiplied by the State labor rate. *(hrs_consult_dssa_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States with model PWS with at least one sample > 10 µg/L	Once a year
f) Review report on DSSA responses				
The hours per system multiplied by the State labor rate. *(hrs_report_dssa_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States with model PWS with at least one sample > 10 µg/L	Once a year

Acronyms: CWS = community water system; CCT = corrosion control treatment; DSSA = Distribution System and Site Assessment; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

[2] As previously discussed in Section 4.3.3.2.2 in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles, shipping, and analyses (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities.

4.4.3.4 State Lead CCT Routine Costs

The EPA developed State costs to review and consult on system's activities related to review of CCT guidance, submitted water quality data during the sanitary survey, and the notification of a source or treatment change as shown in Exhibit 4-166. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-166: State CCT Installation Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
g) Review CCT guidance and applicability to individual PWSs	40 hrs/State/update	*hrs_cct_review_js*
h) Review water quality data with PWSs during sanitary survey	2 to 5 hrs/system/sanitary survey	*hrs_sanit_surv_js*
i) Consult on required actions in response to source water change	• 6 to 12 hrs/system on reduced tap monitoring • 4 to 7 hrs/system on standard tap monitoring	*hrs_coop_source_chng_red_js* *hrs_coop_source_chng_rout_js*

Activity	Unit Burden	*SafeWater LCR Data Variable*
j) Consult on required actions in response to treatment change	46 to 84 hrs/system	*hrs_coop_treat_chng_ js*

Acronyms: CCT = corrosion control treatment; PWS = public water system.
Sources:
g), h): "CCT Study and Review Costs_Final.xlsx."
i): "Likelihood_SourceChange_Final.xlsx."
j): "Likelihood_TreatmentChange_Final.xlsx."

g) ***Review CCT guidance and applicability to individual PWSs (hrs_cct_review_js).*** States will incur burden to review updated EPA guidance, identify changes that could affect their systems, prepare a memo to communicate changes to State surveyors, and be available to answer questions (*hrs_cct_review_js*) at an estimated burden of 40 hours total. The estimate is based on the ASDWA 2024 CoSTS model, section "CCT" (ASDWA, 2024). The EPA assumed this guidance will be updated every 5 years. For the proposed LCRI EA (USEPA, 2023c), the EPA used an estimate of 16 hours based on Indiana's response to a 2016 ASDWA questionnaire.

h) ***Review water quality data with PWSs during sanitary survey (hrs_sanit_surv_js).*** States will also incur burden to review water quality data during sanitary surveys with water systems that have CCT. Exhibit 4-167 provides the data variables and input values associated with this review.

Exhibit 4-167: Estimated State Burden to Review CCT-Related Data during Sanitary Survey

System Size (Population Served)	State Burden (hrs / system) *(hrs_sanit_surv_js)*
≤1,000	2
1,001-10,000	3
10,001-100,000	4
>100,000	5

Note:
The EPA assumed that State burden for reviewing CCT-related non-compliance data would be twice that of the system burden to gather the data (see data variable: *hrs_sanit_surv_op* in Section 4.3.3.4, activity m)) plus 1 hour to discuss the sanitary survey.

The minimum sanitary survey frequency is every 3 years for surface water CWSs and every 5 years for NTNCWSs. The minimum frequency for ground water CWSs is also every 3 years except for the subset that can meet certain treatment or performance criteria. For these systems, the minimum frequency can be extended to every 5 years. Refer to Section 4.3.3.4, activity m) for the likelihood a ground water system will meet these treatment or performance criteria (*p_spec_req)*.

i) ***Consult on required actions in response to source water change (hrs_coop_source_chng_red_js, hrs_coop_source_chng_rout_js).*** Systems are required to seek prior approval before making any source water changes and to consult with the State on needed responses. Exhibit 4-168 provides the estimated State burden estimate of 6 to 12 hours (6 hours most likely) per system per monitoring period for systems on reduced monitoring and an estimate of 4 to 7 hours (4 hours most likely) per system per monitoring period for system on standard monitoring for this review and consultation,

which is based on input received from North Carolina and Indiana in response to a 2016 ASDWA questionnaire regarding potential 2021 LCRR requirements. North Carolina estimated 2 hours to review a change in source from ground water to another ground water source and 3 hours for surface water source changes or surface water/ground water mixing. Indiana estimated 6 hours to review a change to a similar source and 20 hours to review a change to a dissimilar source. The questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

The estimated burden for States to consult with systems in response to source change depends on the system's lead tap monitoring and reporting frequency as follows:

- For systems monitoring less frequently than every 6 months (*hrs_coop_source_chng_red_js*), the EPA used the average of the two estimates of 2 and 6 hours (4 hours) for the minimum and most likely value. The EPA set the most likely equal to the minimum because less than 1 percent of systems made more significant sources changes during 2013-2020. For the maximum, the EPA assumed the 20 hours were more reflective of the system burden to prepare needed documentation and instead set the State burden to equal 50 percent of that estimated for the system (50 percent of 20 hours). Additionally, the EPA assumed States would incur an additional 2 hour burden to consult with the system on needed actions in response to the source change for a total burden of 6 hours for the minimum and most likely and 12 hours for the maximum.
- For systems monitoring every 6 months, the EPA assumed 50 percent of the burden estimated for *hrs_coop_source_chng_rout_js* for the review portion because the State is already reviewing data semi-annually as opposed to annually and an additional 2 hours for the consultation. For the minimum and most likely the burden equals 2 hours for the review plus 2 hours for the consultation for a total of 4 hours. For the maximum, the burden equals 5 hours for the review plus 2 hours for the consultation for a total of 7 hours. Exhibit 4-168.

Exhibit 4-168: Estimated Hours per System for State to Consult on Source Water Change

Hrs per system per monitoring period					
hrs_coop_source_chng_red_js			*hrs_coop_source_chng_rout_js*		
Minimum	**Maximum**	**Most Likely**	**Minimum**	**Maximum**	**Most Likely**
6	12	6	4	7	4

Source: "Likelihood_SourceChange_Final.xlsx."

As discussed in Section 3.3.8.1, the EPA used historical data from SDWIS/Fed to estimate the likelihood that 3.43 percent of CWSs and 1.58 percent of NTNCWSs would have a source change in any given year *(p_source_change)*.

j) Consult on required actions in response to treatment change (hrs_coop_treat_chng_ js; hrs_coop_treat_chng_ js). Systems are also required to seek prior approval before making any long-term treatment changes and to consult with the State on needed responses. The likelihood of a system changing treatment in any given year of 4.2 percent for all CWSs and 3.2 percent for all NTNCWSs (*p_treat_change*) is discussed in Section 3.3.8.3 with estimated percentages for CWSs and

NTNCWSs presented in Exhibit 3-55 and Exhibit 3-56, respectively. Exhibit 4-169 below provides the estimated State burden for this review and consultation, which is based on burden estimates provided by the ASDWA 2024 CoSTS model, section "CCT" (ASDWA, 2024). The EPA assumed the burden for States to review and consult on the treatment change to be the same as the burden needed for water systems to report the change and consult with the States on needed actions. The EPA also assumed based on the ASDWA 2024 CoSTS model that burden would not differ based on the system's monitoring schedule.[152]

Exhibit 4-169: Estimated Hours per System for State to Consult on Treatment Change

System Size (Population Served)	Hrs per system per monitoring period *hrs_coop_treat_chng_ js*
≤100	46
101-500	46
501-1,000	46
1,001-3,300	46
3,301-10,000	84
10,001-50,000	84
>50,000	82

Source: "Probability_TreatmentChange_Final.xlsx."

Exhibit 4-170 details how the data variables are used to estimate State activities related to CCT re-optimization including additional cost inputs that are required to calculate the total costs.

Exhibit 4-170: State CCT Re-optimization Cost Estimation in SafeWater LCR by Activity[1]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
g) Review CCT guidance and applicability to individual PWSs				
The total hours multiplied by the State labor rate. *(hrs_cct_review_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	States with any model PWSs with CCT	Every 5 years
h) Review water quality data with PWSs during sanitary survey				
The hours per system multiplied by the State labor rate. *(hrs_sanit_surv_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	States with any model PWSs that do not meet the special requirements to conduct the Sanitary Survey at a reduced interval 1 – *p_spec_req*	Every 3 years

[152] For the proposed LCRI EA (USEPA, 2023c), the EPA based the State review and consultation burden on North Carolina's response to a 2016 ASDWA questionnaire regarding possible 2021 LCRR requirements. In addition, the EPA had assumed different burdens based on a system's monitoring schedule.

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
			States with any model PWSs that do meet the special requirements to conduct the Sanitary Survey at a reduced interval *p_spec_req*	Every 5 years
i) Consult on required actions in response to source water change				
The hours per system multiplied by the State labor rate. *(hrs_coop_source_chng_rout_js*rate_js)*	Cost applies as written to States for NTNCWSs.	At or below AL	States with any model PWSs not on reduced tap sampling that have a change in source water 1 – *(p_tap_annual + p_tap_triennial + p_tap_nine); p_source_chng*	Once per event
		Above AL	States with any model PWSs with a change in source water *p_source_chng*	
The hours per system multiplied by the State labor rate. *(hrs_coop_source_chng_red_js*rate_js)*		At or below AL	States with any model PWSs on reduced tap sampling that have a change in source water *p_tap_annual, p_tap_triennial, p_tap_nine, p_source_chng*	
j) Consult on required actions in response to treatment change				
The hours per system multiplied by the State labor rate. *(hrs_coop_treat_chng_js*rate_js)*	Cost applies as written to States for NTNCWSs.	At or below AL	States with any model PWSs with a change in treatment *p_treat_change*	Once per event
		Above AL	States with any model PWSs with a change in treatment *p_treat_change*	

Acronyms: AL = action level; CCT = corrosion control treatment; CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system.
Note:

[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *p_tap_annual, p_tap_triennial,* and *p_tap_nine*: Likelihood a system will qualify to collect the reduced number of lead tap samples at an annual, triennial, and nine-year frequency, respectively (Chapter 3, Section 3.3.7).
- *p_source_chng*: Likelihood that a system will change sources in a given year (Chapter 3, Section 3.3.9.1).
- *p_spec_req*: Likelihood a ground water CWS will meet special conditions to conduct a sanitary survey every 3 years vs. every 5 years (Section 4.3.3.4, activity m)).
- *p_treat_change:* Likelihood that a system will change treatment in a given year (Chapter 3, Section 3.3.9.3).
- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

4.4.4 State Service Line Inventory and Replacement Related Costs

States will incur burden to conduct oversight activities related to systems' SL inventory and replacement programs. Section 4.4.4.1 describes oversight activities associated with the SL inventory and outreach. Section 4.4.4.2 includes activities to review the SLR plan and periodic re-evaluation of SLR rates for systems eligible for a deferred deadline. Section 4.4.4.3 includes the review of the annual SLR report. Exhibit 4-177 at the end of Section 4.4.4.3 provides details on how costs are calculated for State service line inventory and replacement activities a) through e) including additional cost inputs that are required to calculate these costs.

4.4.4.1 SL Inventory Costs

The EPA has identified and developed State costs for activities associated with SL inventory development as shown in Exhibit 4-171. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-171: State SL Inventory Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Review connector updated LCRR initial inventory (baseline inventory) (one-time)	0.5 to 2 hrs/CWS or NTNCWS	*hrs_updated_initial_inv_rev_js*
b) Review annual service line inventory updates	0.5 hrs/CWS or NTNCWS	*hrs_inv_update_rev_js*
c) Review validation report (one-time)	0.5 hrs per CWS	*hrs_inv_valid_rev_js*

Acronyms: CWS = community water system; SL = service lines; NTNCWS = non-transient non-community water system; PWS = public water system.
Sources:
a): "LCRI Updated Initial Inventory with Connectors.xlsx"
b) & c): "Inventory Updates and Validation.xlsx."

a) Review connector updated LCRR initial inventory (baseline inventory) (hrs_updated_initial_inv_rev_js). Under the final LCRI, States will incur a one-time burden to review the updated LCRR initial inventory that includes lead connector information. The EPA assumed States would require 0.5, 1 hour, and 2 hours to conduct this review for CWSs and NTNCWSs serving 3,300 or fewer people; 3,301 to 50,000 people and more than 50,000 people, respectively. This is

half of the CWS burden to prepare and report an updated inventory with connectors (*hrs_report_updated_initial_inv_op).*[153]

b) ***Review annual service line inventory updates (hrs_inv_update_rev_js).*** The EPA assumed States will incur an annual burden to review CWS and NTNCWS updated inventories. The EPA estimated the State will require 0.5 hours to review each update.

c) ***Review inventory validation report (hrs_inv_valid_rev_js).*** The EPA assumed States will incur a one-time burden to review CWS and NTNCWS validation results. The EPA estimated the State will require 0.5 hours to review the validation results. ASDWA agreed with this estimate in their 2024 CoSTS model (ASDWA, 2024).

4.4.4.2 SLR Plan Review Costs

The EPA has identified and developed State costs for activities associated with the review of the SLR plan and annual SLR report as shown in Exhibit 4-172. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-172: State SLR Plan and Deferred Replacement Deadline Review Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
d) Review initial SLR plan (one-time)	6 to 18 hours/CWS 6 hours/NTNCWS	*hrs_slr_plan_js*
e) Review information on deferred deadline and associated replacement rate in the SLR plan and determine fastest feasible rate (one-time)	1.5 to 4.5 hrs/CWS seeking a deferred SLR rate; 1.5 hrs/NTNCWS seeking a deferred SLR rate	*hrs_slr_plan_defer_js*
f) Review annually updated SLR plan or certification of no change	1 to 2 hrs/CWS; 1 hr/NTNCWS	*hrs_slr_plan_update_js*
g) Conduct triennial review of water system updated recommended deferred deadline and associated replacement rate and determine fastest feasible rate	1.5 to 4.5 hrs/CWS on a deferred SLR rate; 1.5 hrs/NTNCWS on a deferred SLR rate	*hrs_defer_update_js*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; PWS = public water system; SLR = service line replacement.
Source: "LSLR Ancillary Costs_Final.xlsx."

[153] The burden estimate in the proposed LCRI EA (USEPA, 2023c) of 1 hour per CWS and NTNCWS for all size categories did not reflect the larger number of service lines for larger systems compared to smaller systems. The former will have a more extensive inventory. Using half of the CWS estimate is an approach used for other State inputs. The EPA used half the burden for CWSs to estimate the State review of NTNCWSs because the estimate for NTNCWS to report their updated inventory with connectors (3.75 to 15 hrs) includes hours to compile the connector information in addition to reporting.

d) ***Review initial SLR plan (hrs_slr_plan_js).*** States will incur burden to review the SLR plan that water systems with lead, GRR, and/or unknown service lines must prepare (see activity g) in Section 4.3.4.2 for required elements of the plan). The State burden (*hrs_slr_plan_js*) is based on the ASDWA 2020 CoSTS model that assumed 6 hours for States to review the plan for small CWSs (assumed to serve 3,300 or fewer people) and NTNCWSs, 10 hours for medium CWSs (assumed to serve 3,301 to 50,000 people), and 18 hours for large CWSs (assumed to serve more than 50,000 people) (ASDWA, 2020b; 2024). ASDWA's estimates remained the same in their 2024 CoSTS model.

e) ***Review information on deferred deadline and associated replacement rate in the SLR plan and determine fastest feasible rate (hrs_slr_plan_defer_js).*** States will incur burden to conduct an additional review for systems requesting a deferred replacement deadline in their initial SLR plan. The State must determine whether the system's requested deferred deadline and associated cumulative average replacement rate are the fastest feasible to conduct mandatory SLR. If the requested rate is not the fastest feasible, the State must set a new deferred deadline and replacement rate that is the fastest feasible for the system. The State must consider information that includes, but is not limited to, the system's submissions of the service line inventory and replacement plan and information collected from other water systems conducting mandatory SLR. The EPA assumed that States would incur half the burden required for systems to prepare the additional information, as shown in Exhibit 4-173 below.

Exhibit 4-173: Estimated Additional Burden for States to Review the Initial SLR Plan for Systems Requesting a Deferred Replacement Deadline

System Size (Population Served)	*hrs_slr_plan_defer_js*	
	CWSs	**NTNCWSs**
≤3,300	1.5	1.5
3,301-10,000	2.5	1.5
10,001-50,000	2.5	1.5
>50,000	4.5	1.5

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "LSLR Ancillary Costs_Final.xlsx."
Notes: This additional burden only applies to States reviewing the SLR plan for CWSs requesting a deferred replacement deadline.

f) ***Review annually updated SLR plan or certification of no change (hrs_slr_plan_update_js).*** All systems with lead, GRR, and/or unknown service lines must either update their SLR plan annually, starting in Year 2 (*i.e.*, Year 5 of the period of analysis), to include any significant changes, such as updates to relevant regulations, approach for identifying unknowns or submit a certification of no change. The EPA assumed the majority of systems will not need to update their SLR program but instead will provide a certification of no change. The EPA assumed that States would incur half the burden required for systems to prepare the updated plan or certification, as shown in Exhibit 4-174 below.

Exhibit 4-174: Estimated Annual Burden for States to Review SLR Plan Updates or Certifications of No Changes

System Size (Population Served)	*hrs_slr_plan_update_js*	
	CWSs	NTNCWSs
≤3,300	1	1
3,301-10,000	1.5	1
10,001-50,000	2	1
>50,000	2	1

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "LSLR Ancillary Costs_Final.xlsx."
Notes: Systems with lead, GRR, or unknowns must annually update their SLR plan if they have a significant change or must instead certify to the State that they have no changes.

g) ***Conduct triennial review of water system updated recommended deferred deadline and associated replacement rate and determine fastest feasible rate (hrs_defer_update_js).*** By the end of the fifth program year, and every three years thereafter, the State must review the system's updated recommendation of the deferred deadline and associated replacement rate and determine if a shorter deadline is feasible. If the requested rate is not the fastest feasible, the State must set a new deferred deadline and replacement rate that is the fastest feasible for the system. The EPA assumed that States would incur half the burden required for systems to prepare the update required for their replacement plan, which equates to 1.5 hour for CWSs serving 3,300 or fewer people and all NTNCWSs, 2.5 hours for CWSs serving 3,301 to 50,000 people, and 4.5 hours for CWSs serving more than 50,000 people.

4.4.4.3 SLR Report Review Costs

The EPA has identified and developed State costs for an activity associated with the review of the annual SLR report, as shown in Exhibit 4-175 . The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-175: State Report Review Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
h) Review annual SLR program report	1 to 4 hours/CWS 1 hour/NTNCWS	*hrs_report_lcr_js*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; SLR = service line replacement.

h) ***Review annual SLR program report (hrs_report_lcr_js).*** States will incur burden to review annual information submitted by water systems related to their SLR program, including the location of each lead and GRR service line and lead connector replaced, the number of unknown service lines

determined to be non-lead, the number of unknown service lines remaining, their replacement schedule, and other information as required under 40 CFR 141.90(e). This information is expected to be in the form of an annual report. Exhibit 4-176 provides the estimated burden associated with this review. For the proposed LCRI EA, the EPA assumed that the State review burden would be half of the system burden to prepare the SLR program report (as presented in Section 4.3.4.4, activity r)). For this final LCRI EA, the EPA used the burden estimates provided in the ASDWA 2024 CoSTS model (ASDWA, 2024) for CWSs serving less than or equal to 3,300 people (1 hr), CWSs serving 50,001 to 100,000 (3 hrs), and all NTNCWS (1 hr). The EPA continued to use the estimated burden from the proposed LCRI EA for all other CWS size categories because it was higher or the same as the ASDWA 2024 CoSTS model.

Exhibit 4-176: State Burden to Review System's Annual Service Line Replacement Report (hrs per system)

System Size (Population Served)	CWSs	NTNCWSs
	SafeWater cost input ID: hrs_report_lcr_js	
	A	B
≤3,300	1	1
3,301-10,000	1	1
10,001-50,000	2	1
50,001 – 100,000	3	1
>100,000	4	1

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "LSLR Ancillary Costs_Updated.xlsx."

Exhibit 4-177 provides the SafeWater LCR model costing approach including additional cost inputs that are required to calculate the total costs.

Exhibit 4-177: State Service Line Replacement Cost Estimation in SafeWater LCR by Activity[1,2]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[3]	
a) Review connector updated LCRR initial inventory (baseline inventory)				
The hours per system multiplied by the State labor rate. *hrs_updated_initial_inv_rev_js*rate_js*	Cost applies as written to States for NTNCWSs.	All	States with any model PWSs	Once per year for the first three years
b) Review annual service line inventory updates				
The hours per system multiplied by the State labor rate. *(hrs_inv_update_rev_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	States with any model PWSs with service lines of lead or unknown content	Once per year for the first 10 years

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[3]	
c) Review inventory validation report				
The hours per system multiplied by the State labor rate. *(hrs_inv_valid_rev_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	States with any model PWSs with service lines of lead content or unknowns	One Time
d) Review initial SLR plan				
The hours per system multiplied by the State labor rate. *(hrs_slr_plan_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	States with any model PWSs with service lines containing lead content or unknowns	One Time
e) Review information on deferred deadline and associated replacement rate in the SLR plan and determine fastest feasible rate				
The hours per system multiplied by the State labor rate. *(hrs_slr_plan_defer js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	Model PWSs seeking a deferral.	One time
f) Review annually updated SLR plan or certification of no change				
The hours per system multiplied by the State labor rate. *(hrs_slr_plan_update js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	Model PWSs with service lines of lead, GRR, and/or unknown service lines	Year 5 and annually thereafter
g) Conduct triennial review of water system updated recommended deferred deadline and associated replacement rate and determine fastest feasible rate				
The hours per system multiplied by the State labor rate. *(hrs_slr_defer_update_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	Model PWSs on a deferred SLR rate	Year 8 and triennially thereafter
h) Review annual SLR program report				
The hours per system multiplied by the State labor rate. *(hrs_report_lcr_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	States with any model PWSs that are replacing lead or GRR service lines	Once a year

Acronyms: AL = action level; CWS = community water system; GRR = galvanized requiring replacement; LSL = lead service line; LSLR = lead service line replacement; NTNCWS = non-transient non-community water system; PWS = public water system; SLR = service line replacement.

Notes:

[1] The data variables in the exhibit are defined previously in this section with the exception of the following:

- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

[2] As previously discussed in Section 4.3.4.4, in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles and shipping and conducting the analysis for samples following LSLR (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities.

[3] PWSs with lead content or unknown lines are identified using the data variables and approach described in Chapter 3, Section 3.3.4.

4.4.5 State POU Related Costs

States will incur both one-time and ongoing burden to conduct oversight activities related to systems' POU programs. CWSs serving 3,300 or fewer people and NTNCWSs with a lead 90th percentile above the AL must evaluate and recommend to their State which compliance alternative they plan to implement that can include POU device installation and maintenance. State activities and associated SafeWater LCR model cost inputs for one-time and ongoing activities are described in Sections 4.4.5.1 and 4.4.5.2, respectively.

4.4.5.1 One-Time POU Program Costs

The EPA has developed costs for three one-time State activities related to POU program oversight as shown in Exhibit 4-178. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burdens follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-178: State One-Time POU-Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Review POU plan	37 to 67 hrs/CWS serving ≤ 3,300; 29.5 to 67 hrs/NTNCWS	*hrs_pou_plan_rev_js*
b) Provide templates for POU outreach materials	0.25 to 0.5 hrs/CWS serving ≤ 3,300 and NTNCWS	*hrs_temp_pou_js*
c) Review POU public education materials	0.5 hrs/CWS serving ≤ 3,300; 0.5 to 2 hrs/NTNCWSs	*hrs_review_pe_pou_js*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.
Source:
a): "POU Inputs_Final.xlsx."
b) & c): "Public Education Inputs_CWS_Final.xlsx"; "Public Education Inputs_NTNCWS_Final.xlsx."
Notes:
c): States will only conduct these activities for the subset of CWS serving ≤3,300 people and NTNCWSs with a lead ALE and for which POU provision and maintenance is their approved lead compliance option.

a) Review POU plan (hrs_pou_plan_rev_js). As previously stated in Section 4.3.5.2, the rule does not explicitly require systems to prepare a POU plan under the small system flexibility requirements. However, the EPA assumed systems would prepare a plan and States would incur burden to review water systems' POU plans. These assumptions are made given the desire in the EA to capture all reasonable costs incurred by the impacted entities and the high likelihood that States will want to have oversight on the human health protective actions being taken by a system in response to high lead samples at households. The SafeWater LCR model assumes that these plans are developed by CWSs serving 3,300 or fewer people and NTNCWSs that meet the following criteria: 1) have no CCT, 2) have a lead ALE, and 3) POU provision and maintenance is their approved compliance option. The EPA assumed that State burden to review the plan is 25 percent of the PWS burden to prepare the plan (*hrs_pou_plan_dev_op*), excluding the system's burden for board/management and legal

consultation.[154] The State burden is provided in Exhibit 4-179. See Section 4.3.5.2, activity b) for assumptions used to estimate the PWS burden. The EPA estimates NTNCWSs on average will have more taps that will require POU devices than CWSs and thus they will require additional burden to develop the plan and for the State to review the plan.

Exhibit 4-179: Estimated Hours for State Review of POU Plan (hrs/system)

System size (Population Served)	CWSs	NTNCWSs
	SafeWater LCR Data Variable: hrs_pou_plan_rev_js	
	A	B
≤500	37	29.5
501-3,300	67	42
3,301 to 10,000	N/A	42
10,001-50,000	N/A	67
50,001-1,000,000	N/A	42
>1,000,000	N/A	

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use.
Source: "POU Inputs_Final.xlsx."
Notes:
A: The EPA assumed States will incur 25 percent of the burden as to review the plan as for water systems to prepare the plan (see data variable *hrs_pou_plan_dev_op* in Section 4.3.5.2, activity b)), excluding the system's burden for board/management and legal consultation.
B: No NTNCWSs serves more than 1 million people; thus, the burden for this size category is 0. The EPA estimates that NTNCWSs serving 10,001 – 50,000 people have the highest estimated number of taps, will have a higher burden to prepare the POU plan, and States will require additional burden to review the plan. See "POU Inputs_Final.xlsx" for the approach for estimating the required number of POU devices.

b) ***Provide templates for POU outreach materials (hrs_temp_pou_js).*** The EPA assumed that States will provide templates to CWSs serving 3,300 or fewer people and NTNCWSs to develop POU outreach materials that describe the POU program and proper use of the POU devices. The EPA assumed States will incur a one-time burden of 0.25 to 0.5 hours to provide these templates based on responses to an ASDWA survey regarding the burden to provide revised sampling instruction templates from North Carolina and Indiana of 0.25 and 0.5 hours, respectively. The questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

c) ***Review POU public education materials (hrs_review_pe_pou_js).*** CWSs serving 3,300 or fewer people with a lead ALE that selected the POU option must provide public education on the use of POU device to all households they serve. NTNCWSs must provide this outreach to the consumers they serve. The EPA estimated that States will incur a one-time burden to review these public education materials of 0.5 hours for CWSs serving 3,300 or fewer people and NTNCWSs serving

[154] For the proposed LCRI EA, the EPA estimated the State burden to be 50 percent of the burden estimated for a water system to prepare the plan. For the final LCRI EA, EPA revisited its assumption due to the low estimated burden of 2 to 4 hours for this review provided by ASDWA in its 2024 CoSTS model (ASDWA, 2024).

50,000 or fewer. The EPA assumed States would require 2 hours to review these materials for NTNCWSs serving more than 50,000 people. ASDWA agreed with this estimate in their 2024 CoSTS model (ASDWA, 2024).

Exhibit 4-182 in Section 4.4.5.2 provides the SafeWater LCR model approach including additional cost inputs that are required to calculate the total costs.

4.4.5.2 Ongoing POU Program Costs

The EPA has developed costs for three ongoing State activities related to POU program oversight as shown in Exhibit 4-180. The exhibit provides the unit burden for each activity. The assumptions used in the estimation of the unit burdens follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-180: State Ongoing POU-Related Burden Estimates

Activity	Unit Burden	*SafeWater LCR Data Variable*
d) Review sample invalidation request for POU monitoring	2 hrs/request	*hrs_samp_invalid_js*
e) Review customer notification certifications	0.33 to 0.5/certification	*hrs_cert_cust_lt_js*
f) Review annual POU program report	0.5 hrs/CWS; 0.5 to 4 hr/NTNCWS	*hrs_pou_report_ann_rev_js*

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use.
Sources:
d) & e): "Lead Analytical Burden and Costs_Final.xlsx."
f): "POU Inputs_Final.xlsx."

- ***d) Review sample invalidation request for POU monitoring (hrs_samp_invalid_js).*** Systems must sample one-third of locations with POU devices annually. For CWSs, all households must have POU devices, so sampling must occur at one third of households. The number of households per system is estimated as the retail population (*pws_pop*) divided by the total number of households per system of 2.53 (*numb_hh*). For NTNCWSs, the number of POUs is equivalent to the number of taps used for drinking water consumption. See Section 4.3.5.1 for additional details and values for these inputs. The EPA assumed that 0.6 percent of samples will be invalidated, consistent with the assumption for other compliance tap sampling (*pp_samp_invalid*). See Section 4.3.2.1.2, activity f) for additional information. The EPA assumed States will require 2 hours per sample invalidation request based on a 2016 ASDWA questionnaire. The questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov. Note that ASDWA agreed with the estimate of 2 hours in their 2024 CoSTS model (ASDWA, 2024).

e) Review customer notification certifications (hrs_cert_cust_lt_js). As discussed in Section 4.4.2.1, the burden for States to review each system's certification that monitoring results were reported to customers is 0.33 hours to 0.5 hours and is based on North Carolina and Indiana's estimates for this review, respectively, in response to a 2016 ASDWA questionnaire. The EPA assumed this review has

the same burden regardless of whether the lead tap sample is collected at a site with or without a POU device and thus used the same data variable and input. The questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

f) Review annual POU program report (hrs_pou_report_ann_rev_js). States will incur burden to review a system's annual report on its POU program that includes monitoring results and may include corrective actions and routine maintenance activities. The EPA estimated that States will incur 50 percent of the burden to review the plan as assumed for the system to prepare the plan (*hrs_pou_report_ann_prep_op*). See Exhibit 4-181 for the estimated burden to review POU reports for CWSs and NTNCWSs.

Exhibit 4-181: State Burden to Review Annual POU Program Report (hours/system)

System size (Population Served)	CWSs	NTNCWSs
	SafeWater Cost Model Input: *hrs_pou_report_ann_rev_js*	
	A	B
≤3,300	0.5	0.5
3,301-10,000	N/A	1
10,001-50,000	N/A	2
50,001-100,000	N/A	2
100,001-1,000,000	N/A	4
>1,000,000	N/A	

Acronyms: CWS = community water system; NTNCWS = non-transient non-community water system.
Source: "POU Inputs_Final.xlsx."
Notes:
A & B: Estimated as 50 percent of system burden to prepare the report (*hrs_pou_report_ann_prep_op*). See Section 4.3.5.2, activity m) for details. No NTNCWSs serves more than 1 million people. Thus, the burden for this size category is 0.

Exhibit 4-182 provides the SafeWater LCR model costing approach for POU-related activities a) through f) including additional cost inputs that are required to calculate the total costs.

Exhibit 4-182: State POU Cost Estimation in SafeWater LCR (by Activity)[1,2]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions	
a) Review POU plan				
The hours per system multiplied by the State labor rate. *(hrs_pou_plan_rev_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with model PWSs installing POU devices or conducting a POU plan	One time
b) Provide templates for POU outreach materials				
The hours per system multiplied by the State labor rate. *(hrs_temp_pou_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with model PWSs installing POU devices or conducting a POU devices	One time
c) Review POU public education materials				
The hours per system multiplied by the State labor rate. *(hrs_review_pe_pou_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with any model PWSs installing POU devices	One time
d) Review sample invalidation request for POU monitoring				
One third of households per system where the sample is determined to be invalid (assume one sample per household) multiplied by the hours per sample per system and the State labor rate. *(((1/3)*(pws_pop/numb_hh)*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	One third the number of POU devices per system where the sample is determined to be invalid (assume one sample per POU device) multiplied by the hours per sample per system and the State labor rate. *(((1/3)*numb_pou)*pp_samp_invalid)*(hrs_samp_invalid_js*rate_js)*	All	States with any model PWSs installing POU devices	Once a year
e) Review customer notification certifications				
The hours per system multiplied by the State labor rate. *(hrs_cert_cust_lt_js*rate_js)*	Cost applies as written to States for NTNCWSs	All	States with any model PWSs installing POU devices	Once a year
f) Review annual POU program report				
The hours per system multiplied by the State labor rate. *(hrs_pou_report_ann_rev_js*rate_js)*	Cost applies as written to States for NTNCWSs	All	States with any model PWSs installing POU devices	Once a year

Acronyms: AL = action level; CWS = community water system; NTNCWS = non-transient non-community water system; POU = point-of-use; PWS = public water system.
Notes:
[1] The data variables in the exhibit are defined previously in this section with the exception of:

- *numb_pou*: Number of POU devices per PWSs that elects POU option (Section 4.3.5.1).
- *pp_samp_invalid*: Likelihood that a lead sample will be deemed invalid (Section 4.3.2.1.2, activity f)).
- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

[2] As previously discussed in Section 4.3.5.2, in Arkansas, Louisiana, Mississippi, Missouri, and South Carolina the State pays for the cost of bottles and shipping and conducting the analysis for samples following LSLR (ASDWA, 2020a). Thus, the State will incur the burden and cost for these activities.

4.4.6 State Public Education-Related Costs

States will incur burden to conduct oversight and review activities related to the public education requirements of the final LCRI. These activities are broadly grouped into those related to: a consumer notice in response to a single lead sample above 10 µg/L that are independent of a system's lead 90th percentile level (see Section 4.4.6.1); independent of a system's lead 90th percentile level (see Section 4.4.6.2); conducted in response to a lead ALE (see Section 4.4.6.3); and required in response to multiple lead ALEs (see Section 4.4.6.4). Exhibit 4-189 in Section 4.4.6.4 provides details on how costs are calculated for State public education activities a) through o) in Sections 4.4.6.1 through 4.4.6.4 including additional cost inputs that are required to calculate these costs.

Note that State public education activities associated with the POU program were previously discussion in Section 4.4.5.

4.4.6.1 Consumer Notice

The EPA has developed State costs related to a system's consumer notice in response to a lead or copper sample of any level, as shown in Exhibit 4-183. The exhibit provides the unit burden. The assumptions used in the estimation of the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-183: PWS Burden for Consumer Notification

Activity	Unit Burden	*SafeWater LCR Data Variable*
a) Provide templates for consumer notice materials	0.25 to 0.5 hrs per PWS	*hrs_consumer_notice_temp_js*
b) Review lead consumer notice materials	0.5 to 2 hours per PWS	*hrs_consumer_notice_rev_js*
c) Review copy of the consumer notice and certification	0.5 hrs/PWS per monitoring period	*hrs_samp_notice_js*

Acronyms: PWS = public water system.
Source: "Public Education Inputs_CWS_Final.xlsx;" "Public Education Inputs_NTNCWS_Final.xlsx."

a) Provide templates for consumer notice (hrs_consumer_notice_temp_js). The EPA assumed that States will provide templates to CWSs to develop consumer notice materials and will incur a one-time burden of 0.25 to 0.5 hours to provide these templates. These estimates are based on responses to a 2016 ASDWA survey regarding the burden to provide revised sampling instruction

templates from North Carolina and Indiana of 0.25 and 0.5 hours, respectively. The questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

b) ***Review lead consumer notice materials (hrs_consumer_notice_rev_js).*** The EPA estimated that States will incur a one-time burden to review public education material developed by CWSs that is described in activity c). The EPA assumed systems serving 50,000 or fewer people will use the template with minor changes. Thus, States will require minimal time to review the public education materials of 0.5 hours per system. Systems serving more than 50,000 people will adapt the template and States will require 2 hours per system to review these materials.

c) ***Review a copy of the consumer notice and certification (hrs_samp_notice_js).*** The EPA assumed States will incur a burden of 0.5 hours per PWS per monitoring period to review a sample copy of the consumer notification and a certification that the notification was distributed in a manner that meets the rule requirements that must be submitted by CWSs and NTNCWSs. This estimate is based on the ASDWA 2024 CoSTS model, section "Public Education & Notif." (ASDWA, 2024) and is an increase from that used for the proposed LCRI EA (2023c) of 0.8 hours per system per sampling period.

4.4.6.2 Activities Regardless of the Lead 90th Percentile Level

The EPA has developed system costs for activities associated with public education requirements under the final LCRI that are independent of a system's lead 90th percentile status, as provided in Exhibit 4-184. The exhibit provides the unit burden. The assumptions for the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-184: State Burden for Public Education Activities that Are Independent of Lead 90th Percentile Levels

Activity	Unit Burden	*SafeWater LCR Data Variable*
d) Provide templates for updated CCR language (one-time)	0.25 to 0.5 hrs/CWS	*hrs_temp_ccr_js*
e) Provide templates for local and State health departments lead outreach	0.25 to 0.5 hrs/CWS	*hrs_pub_temp_hc_js*
f) Review lead outreach materials for State and local health departments	0.5 to 2 hrs/CWS	*hrs_pub_rev_hc_js*
g) Participate in joint communication efforts with local and State health departments	1 hr/CWS	*hrs_hc_js*
h) Provide templates for service line disturbance outreach materials	0.25 to 0.5/CWS	*hrs_wtr_temp_js*
i) Review public education materials for service line disturbances	0.5 to 2 hrs/CWS with LSLs	*hrs_review_wtr_pe_js*
j) Provide templates for inventory-related outreach materials (one-time)	0.25 to 0.5/CWS or NTNCWS	*hrs_pe_lsl_gen_temp_js*
k) Review inventory-related outreach materials (one-time)	0.5 to 2 hours/CWS or NTNCWS	*hrs_pe_lsl_rev_js*

Activity	Unit Burden	*SafeWater LCR Data Variable*
l) Provide technical assistance to PWSs for public education materials	0.375 to 0.75 hours per CWS per year $200 to $400 per CWS per year	*hrs_translate_phone_js* *cost_translate_state*
m) Review public education certifications	<u>CWSs</u> 1 to 1.5 hrs/CWS <u>NTNCWSs</u> 0.33 to 0.5 hr/NTNCWS	<u>CWSs</u> *hrs_pe_certify_quarterly_js* <u>NTNCWSs</u> *hrs_cert_outreach_annual_js*

Acronyms: CCR = consumer confidence report; CWS = community water system; LSL = lead service lines; NTNCWS = non-transient non-community water system.
Sources:
d) – i): "Public Education Inputs_CWS_Final.xlsx."
j) – m): "Public Education Inputs_CWS_Final.xlsx;" "Public Education Inputs_NTNCWS_Final.xlsx."

d) Provide templates for updated CCR language (hrs_temp_ccr_js). The EPA assumed that States will provide templates to CWSs to update their CCR language to include the revised mandatory health effects language and for those with lead, GRR, and unknown service lines to further update their materials to include information about the system's SLR program and opportunities to replace LSLs and GRR service lines. In addition, CWSs that have LSLs, GRR, or service lines of unknown material must also include information on how to access the SL inventory and how to access the results of all tap sampling in the CCR. The EPA assumed States will incur a one-time burden of 0.25 to 0.5 hours to provide these templates. These estimates are based on responses to an ASDWA survey regarding the burden to provide revised sampling instruction templates from North Carolina and Indiana of 0.25 and 0.5 hours, respectively. This estimate is the same as the estimated burden to provide the sampling template *(hrs_rev_samp_js)* as discussed in Section 4.4.2.1, activity a). The questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

e) Provide templates for local and State health departments lead outreach (hrs_pub_temp_hc_js). The EPA assumed States will incur a one-time burden to provide templates to CWSs to develop outreach materials that will be sent to State and local health departments. The EPA assumed States will incur a one-time burden of 0.25 to 0.5 hours to provide these templates. These estimates are based on responses to an ASDWA survey regarding the burden to provide revised sampling instruction templates from North Carolina and Indiana of 0.25 and 0.5 hours, respectively. This estimate is the same as the estimated burden to provide the sampling template *(hrs_rev_samp_js).*The questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

f) Review lead outreach materials for local and State health departments (hrs_pub_rev_hc_js). The EPA estimated that States will incur a one-time burden to review public education material developed by CWSs that is described in activity e). The EPA assumed systems serving 50,000 or fewer people will use the template with minor changes. Thus, States will require minimal time to review the public education materials of 0.5 hours per system. Systems serving more than 50,000

people will adapt the template and States will require more time to review these materials of 2 hours per system.

g) ***Participate in joint communication efforts with local and State health departments (hrs_hc_js).*** States will incur annual burden to participate in joint communication efforts with CWSs to provide lead public education to health departments annually. The EPA assumed that water systems would have the major role in this activity, but States would provide support to develop joint letters to be sent to State and local health departments of 1 hour per system. ASDWA agreed with this estimate in their 2024 CoSTS model (ASDWA, 2024).

h) ***Provide templates for service line disturbance outreach materials (hrs_wtr_temp_js).*** The EPA assumed that States will provide templates for CWSs with lead, GRR, or unknown service lines to develop materials when a water system causes disturbances to service lines that can result from scheduled water-related work. Under the final LCRI, these materials also apply when disturbances occur during service line inventory investigations. These estimates are based on responses to an ASDWA survey regarding the burden to provide revised sampling instruction templates from North Carolina and Indiana of 0.25 and 0.5 hours, respectively.

i) ***Review public education materials for service line disturbances (hrs_review_wtr_pe_js).*** The EPA estimated that States will incur a one-time burden to review public education material developed by CWSs with lead, GRR, or unknown service lines for delivery during scheduled water-related work or when disturbances occur during service line inventory investigations. The EPA assumed systems serving 50,000 or fewer people will use the template with minor changes. Thus, States will require minimal time to review the public education materials of 0.5 hours per system. Systems serving more than 50,000 people will adapt the template and States will require 2 hours per system to review these materials.

j) ***Provide templates for inventory-related outreach materials (hrs_pe_lsl_gen_temp_js).*** CWSs and NTNCWSs with LSLs must provide notification to customers served by lead, GRR, or unknown service lines regarding information on the health effects and sources of lead in drinking water (including SLs), how to have water tested for lead, actions customers can take to reduce exposure to lead, and information about the opportunities for SLR. The EPA estimates that States will incur a one-time burden to provide a template for SLR outreach of 0.25 to 0.5 hours. The EPA assumed that the burden to provide the outreach template would be the same as the burden to provide a template for updated sampling instructions *(hrs_rev_samp_js)*. The burden estimates are based on North Carolina and Indiana's response to a 2016 ASDWA survey. The questionnaire and each State's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

k) ***Review inventory-related outreach materials ((hrs_pe_LSL_rev_js).*** States will incur one-time burden to review the inventory-related outreach materials before they are made publicly available. The EPA assumed CWSs serving 50,000 or fewer people will use the templates with minor modification and thus, States will require minimal time to review the outreach materials of 0.5 hours per system. The EPA assumed that systems serving more than 50,000 people will adapt template and States will require 2 hours per system to review these materials.

l) ***Provide technical assistance to PWSs for public education materials (hrs_translate_phone_js, cost_translate_state).*** As previously discussed in Section 4.3.6.2, under activity r), the final LCRI

requires States, as a condition of primacy to provide translation support for public education materials listed under § 141.85 if the water system is unable to do so. The EPA assumes that States will provide translation support for small systems serving 10,000 or fewer people. As was true for CWSs, the EPA assumes that the labor burden and non-labor costs for written or phone translation support will depend on the CWS's public education category for which the State is providing support (*i.e.,* notification of service line material for CWS with lead, GRR, or unknown service lines; public education for CWSs with lead ALEs; or public education material for CWSs with multiple lead ALEs).

Exhibit 4-185 shows the estimated burden for States to provide phone translation support by system public education category for systems serving 10,000 or fewer people. The EPA used the same approach to estimate the State burden to provide phone translation support for CWSs serving 10,000 or fewer people as that described for CWSs serving more than 10,000 people under activity r) in Section 4.3.6.2 with the following exceptions. The EPA assumed States would provide support for fewer phone calls due to the smaller number of people receiving public education materials in systems serving 10,000 or fewer people compared to those serving more than 10,000 people. The EPA estimated that States would annually receive on average one call per year for systems with lead, GRR or unknown service lines, two calls for each CWS with a lead ALE, and an additional two calls for each CWS with multiple lead ALEs. The EPA assumed there are no non-labor costs for States to provide phone translation, which is consistent with the Final CCR3 EA (USEPA, 2024a).

Exhibit 4-186 provides the unit cost for States to provide a written translation for CWSs serving 10,000 or fewer people with lead, GRR, or unknown service lines; a lead ALE; and multiple lead ALEs. The EPA used the same approach to estimate the State cost to provide written translation support to CWSs serving 10,000 or fewer people as that described for CWSs serving more than 10,000 people under activity r) in Section 4.3.6.2.

Exhibit 4-185: Unit Burden per CWS for States to Provide Phone Translation by Type of Public Education Material

System Size (Population Served)	LOE per Translation	Public Education for Customers Served by Lead, GRR, and Unknown SL		Public Education for All Customers in CWSs with a Lead ALE		Public Education for All Customers in CWSs with Multiple Lead ALEs	
		Average Number of Phone Calls per Year	Total Translation Burden per CWS per Year *(SafeWater LCR Input: hrs_translate_phone_op)*	Average Number of Phone Calls per Year	Total Translation Burden per CWS per Year *(SafeWater LCR Input: hrs_translate_phone_op)*	Average Number of Phone Calls per Year	Total Translation Burden per CWS per Year *(SafeWater LCR Input: hrs_translate_phone_op)*
	A	B	C=A*B	D	E = A*D	F	G = A *F
≤100	0.375	1	0.375	2	0.75	2	0.75
101-500	0.375	1	0.375	2	0.75	2	0.75
501-1,000	0.375	1	0.375	2	0.75	2	0.75
1,001-3,300	0.375	1	0.375	2	0.75	2	0.75
3,301-10,000	0.375	1	0.375	2	0.75	2	0.75
10,001-50,000	0.375	0	0	0	0	0	0
50,001-100,000	0.375	0	0	0	0	0	0
100,001-1,000,000	0.375	0	0	0	0	0	0
>1,000,000	0.375	0	0	0	0	0	0

Acronyms: ALE = action level exceedance; CWS = community water system; GRR = galvanized requiring replacement; SL = service line.

Notes:

General: The EPA assumes that for phone translation services, CWSs serving more than 10,000 people will provide phone translation (See Section 4.3.6.2, activity r)), whereas the State will provide phone translation for CWSs serving 10,000 or fewer people.

A: This is the average burden per CWS for a State to provide translation call-in support. The EPA assumed that these calls would be a duration of between 15 to 30 minutes, consistent with the assumptions for phone support for small systems translating the CCR as presented in the Final CCR3 EA (USEPA, 2024a).

B: The average number of calls per year the State will support for each system with lead, GRR or unknown service lines is estimated to be one because the education materials will be delivered to a subset of customers (those with lead, GRR, and unknown service lines) as opposed to all customers.

D: Assumes States will provide phone translation assistance for two calls per year for each system that has a lead ALE.

F: Assumes States will provide phone translation assistance for two additional average number of calls per year for each system with multiple lead ALEs. The two additional call estimate is based on the EPA's assumption that enhanced outreach will result in more customers potentially becoming aware of the ALE and requesting translation assistance. The number of calls shown is the increment beyond the number that is estimated for a lead ALE in Column D.

Exhibit 4-186: **Unit Costs per CWS for States to Provide Written Translations by Type of Public Education Material**

System Size (Population Served)	Average Cost per Translated PE Material	Number of Languages	Public Education for Customers Served by Lead, GRR, and Unknown SL		Public Education for All Customers in CWSs with a Lead ALE		Public Education for All Customers in CWSs with Multiple Lead ALEs	
			Annual Number of PE Materials Being Translated	Total Translation Cost per CWS per Year *(SafeWater LCR Input: cost_translate_cws)*	Annual Number of PE Materials Being Translated	Total Translation Cost per CWS per Year *(SafeWater LCR Input: cost_translate_cws)*	Annual Number of PE Materials Being Translated	Total Translation Cost per CWS Per Year *(SafeWater LCR Input: cost_translate_cws)*
	A	B	C	D = A*B*C	E	F = A*B*E	G	H = A*B*G
≤100	$200	1	1	$200	2	$400	2	$400
101-500	$200	1	1	$200	2	$400	2	$400
501-1,000	$200	1	1	$200	2	$400	2	$400
1,001-3,300	$200	1	1	$200	2	$400	2	$400
3,301-10,000	$200	1	1	$200	2	$400	2	$400
10,001-50,000	$200	1	0	0	0	$400	0	$0
50,001-100,000	$200	2	0	0	0	$800	0	$0
100,001-1,000,000	$200	2	0	0	0	$800	0	$0
>1,000,000	$200	2	0	0	0	$800	0	$0

Acronyms: ALE = action level exceedance; CWS = community water system; GRR = galvanized requiring replacement; PE = public education; SL = service line.

Notes:

General: The EPA assumes that for written translation services, CWSs serving more than 10,000 people will provide written translation (See Section 4.3.6.2, activity r)), whereas the State will provide written translation for CWSs serving 10,000 or fewer people.

A: This is the estimated average cost for the State to pay for contractor support to provide written translation service, based on a typical word count of public education materials of 1,000 multiplied by $0.20 per word for translation services.

B. Assumes States will provide translated materials in one language for systems serving 10,000 or fewer people based on data from the ACS, which provided the population of metropolitan areas with limited English proficiency.

C: Assumes translation of one document per year per CWS for notification of service line material for customers served by a lead, GRR, or unknown service line.

E: Assumes States will provide one translated document per 6-month period for a total of two documents for each CWS with a lead ALE per year.

G: Assumes States will provide each CWS with multiple ALEs one translated documents per 6-month period for a total of two additional documents per year per CWS. The number of written translations shown is incremental to the estimate for a lead ALE in Column E.

m) Review public education certifications (hrs_pe_certify_quarterly_js, hrs_cert_outreach_annual_js). States will review each system's certification that they have met their public education and outreach requirements including any conducted in response to a lead ALE. Under the final LCRI, systems must resubmit copies of their public education and outreach materials along with the certification. CWSs have quarterly, semi-annual, and annual public education requirements in response to a lead ALE (see Section 4.3.6.3 for detailed requirements). Thus, CWSs must report the certification on a quarterly basis. The EPA estimated a range from 0.33 to 0.5 hours to review public education certifications under the pre-2021 LCR based on data from North Carolina and Indiana, respectively, in response to an ASDWA survey about LCR implementation.[155] These estimates were multiplied by 0.75 to account for quarters where there is less information to report on the self-certification. Then the numbers were multiplied by four to account for the quarterly frequency of the self-certification letter. The EPA assumed that the review of each certification for systems serving 50,000 or fewer people would require 0.33 hours or 1 hour annually (based on the lower burden reported from North Carolina) and 0.5 hours/certification or 1.5 hours annually for CWSs serving more than 50,000 people (based on the higher burden reported from Indiana).

NTNCWSs do not have quarterly public education requirements in response to a lead ALE. Instead, they submit an annual certification only *hrs_cert_outreach_annual_js*. The EPA assumed States would spend 0.33 to 0.5 hours per NTNCWS to review their annual certification based on the estimates provided by North Carolina and Indiana.

The EPA assumed that a system's certification would not only include any outreach conducted in response to a lead ALE but also include any public education activities described in Section 4.4.6.

4.4.6.3 Public Education Activities in Response to Lead ALE

The EPA has developed State costs for activities associated with public education requirements in response to a lead ALE as provided in Exhibit 4-187. The exhibit provides the unit burden. The assumptions for the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-187: State Public Education Burden in Response to Lead ALE

Activity	Unit Burden	*SafeWater LCR Data Variable*
n) Provide templates for updated public education materials for systems with a lead ALE (one-time)	0.25 to 0.5/CWS or NTNCWS	*hrs_ale_lang_temp_js*
o) Review revised lead language for systems with a lead ALE (one-time)	0.5 to 2 hrs/CWS or NTNCWS	*hrs_ale_lang_js*
p) Consult with CWS on other public education activities in response to a lead ALE	2 hrs/CWS	*hrs_ale_consult_js*

Acronyms: ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system.

[155] The questionnaire and each state's responses are available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov

Sources:
n) & o): "Public Education Inputs_CWS_Final.xlsx"; "Public Education Inputs_NTNCWS_Final.xlsx."
p): "Public Education Inputs_CWS_Final.xlsx."

n) ***Provide templates for updated public education materials for systems with a lead ALE (hrs_ale_lang_temp_js).*** The final LCRI requires systems with a lead ALE to update the mandatory health effects language and include information on additional steps to reduce lead exposure from drinking water such as the use of filters. For systems with lead, GRR, or unknown service lines, the materials must include SLR and service line material identification opportunities, how to obtain a copy or view the service line inventory and replacement plan, programs to assist with SLR, and the systems' responsibility to replace their portion of the lead or GRR service line when the property owner notifies them that the private-side portion is being replaced. The EPA assumed States will incur a one-time burden of 0.25 to 0.5 hours to provide these templates. These estimates are based on responses to an ASDWA survey regarding the burden to provide revised sampling instruction templates from North Carolina and Indiana of 0.25 and 0.5 hours, respectively.

o) ***Review revised lead language for systems with a lead ALE (hrs_ale_lang_js).*** States will incur a one-time burden to review each system's revised public education mandatory language in materials that are delivered when a system has a lead ALE. The EPA assumed the same burden to review public education language that is used for other types of public education. Specifically, systems serving 50,000 or fewer people will use the template with only very minor changes and States will require 0.5 hours per system for their review. Systems serving more than 50,000 people will adapt the template and States will require 2 hours per system to review these materials.

p) ***Consult with CWS on other public education activities in response to a lead ALE (hrs_ale_consult_js).*** States will consult with CWSs on other required public education activities conducted in response to a lead ALE and will incur a burden of 2 hours per CWS. This assumption is based on the estimate for systems to consult with their State on public education activities used in the *Economic and Supporting Analyses: Short-Term Regulatory Changes to the Lead and Copper Rule* (USEPA, 2007). ASDWA agreed with this estimate in their 2024 CoSTS model (ASDWA, 2024).

Exhibit 4-189 in Section 4.4.6.4 provides details on how costs are calculated for State public education activities a) through o) including additional cost inputs that are required to calculate these costs.

4.4.6.4 Public Education Activities in Response to Multiple Lead ALEs

The EPA has developed State costs for activities associated with public education requirements in response to multiple lead ALEs as provided in Exhibit 4-188. The exhibit provides the unit burden. The assumptions for the unit burden follow the exhibit. The last column provides the corresponding SafeWater LCR model data variable in red/italic font.

Exhibit 4-188: State Public Education Burden in Response to Multiple Lead ALE

Activity	Unit Burden	*SafeWater LCR Data Variable*
q) Review plan for making filters available	2 hours per CWS, 1 hr per NTNCWS	*hrs_temp_filter_plan_dev_js*
r) Provide templates for systems with multiple lead ALEs	0.25 to 0.5 hrs per CWS and NTNCWS with at least 3 lead ALEs in 5 years	*hrs_temp_persist_ale_js*
s) Review outreach materials provided by systems with multiple lead ALEs	0.5 to 2 hrs per CWS and NTNCWS with at least 3 lead ALEs in 5 years	*hrs_review_pe_persist_ale_js*
t) Consult on filter program for systems with multiple lead ALEs (one-time)	2 to 8 hrs per CWS and NTNCWS	*hrs_consult_temp_pou_js_*

Acronyms: ALE = action level exceedance; CWS = community water system; NTNCWS = non-transient non-community water system.
Sources: "Public Education Inputs_CWS_Final.xlsx"; "Public Education Inputs_NTNCWS_Final.xlsx."

q) Review plan for making filters available (hrs_temp_filter_plan_dev_js). Under the final LCRI, State will incur a one-time burden to review filter plans that CWSs and NTNCWSs must develop after they have two lead ALEs in a five-year period. As previously noted in 4.3.6.4, under the proposed LCRI this plan was due after three lead ALEs in a five-year period. The EPA assumed that States would incur half the burden required for systems to develop the plan, which is equivalent to 2 hours per CWS plan, and 1 hour per NTNCWSs plan.

r) Provide templates for systems with multiple lead ALEs (hrs_temp_persist_ale_js). The final LCRI requires CWSs and NTNCWSs that have at least three lead ALEs in a five-year period (*i.e.*, have multiple lead ALEs) to provide enhanced outreach. States will incur one-time burden of 0.25 to 0.5 hours to provide templates that will assist systems in developing their outreach materials, which is the same burden used to provide templates for other public education and outreach materials.

s) Review outreach materials provided by systems with multiple lead ALEs (hrs_temp_persist_ale_js). States will incur one-time burden to review the outreach materials developed by water systems with multiple lead ALEs. The EPA assumed the same burden to review public education language that is used for other types of public education. Specifically, systems serving 50,000 or fewer people will use the template with only very minor changes and States will require 0.5 hours per system for their

review. Systems serving more than 50,000 people will modify the template to better fit the systems needs and States will require 2 hours per system to review these materials.

t) Consult on filter program for systems with multiple ALEs (hrs_consult_temp_pou_js). States will incur a one-time burden to consult with the CWSs and NTNCWSs on specific requirements for its filter program. The EPA estimated systems serving 3,300 or fewer people will require 2 hours, those serving 3,301 to 10,000 people will require 6 hours, and those serving more than 10,000 people will require 8 hours.

Exhibit 4-189 provides details on how total costs for the final LCRI public education requirements are calculated for activities a) through t) including additional cost inputs that are required to calculate the total costs.

Exhibit 4-189: State Lead Public Education Cost Estimation in SafeWater LCR (by Activity)[1, 2]

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[3]	
a) Provide templates for consumer notice materials				
The hours per system multiplied by the State labor rate. *(hrs_consumer_notice_temp_js *rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States	One time
b) Review lead consumer notice materials				
The hours per system multiplied by the State labor rate. *(hrs_consumer_notice_rev_js *rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States	One time
c) Review copy of the consumer notice and certification				
The hours per system multiplied by the State labor rate. *(hrs_samp_notice_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	All States	Once per event
d) Provide templates for updated CCR language				
The hours per system multiplied by the State labor rate. *(hrs_temp_ccr_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States	One time
e) Provide templates for local and State health departments lead outreach				
The hours per system multiplied by the State labor rate. *(hrs_pub_temp_hc_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States	One time
f) Review lead outreach materials for local and State health departments				

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[3]	
The hours per system multiplied by the State labor rate. *(hrs_pub_rev_hc_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States	One time
g) Participate in joint communication efforts with local and State health departments				
The hours per system multiplied by the State labor rate. *(hrs_hc_js*rate_js)*	Cost does not apply to States for NTNCWSs.	All	All States	Once per year
h) Provide templates for service line disturbance outreach materials				
The hours per system multiplied by the State labor rate. (*hrs_wtr_temp_js *rate_js)*	Cost does not apply States for NTNCWSs.	All	States with any model PWSs with service lines of lead or unknown content[3]	One time
i) Review public education materials for service line disturbances				
The hours per system multiplied by the State labor rate. *(hrs_review_wtr_pe_js*rate_js)*	Cost does not apply States for NTNCWSs.	All	States with any model PWSs with service lines of lead or unknown content[3]	One time
j) Provide templates for inventory-related outreach materials				
The hours per system multiplied by the State labor rate. *(hrs_pe_lsl_gen_temp_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	States with any model PWSs with service lines of lead or unknown content[3]	One Time
k) Review inventory-related outreach materials				
The hours per system multiplied by the State labor rate. *(hrs_pe_lsl_rev_js*rate_js)*	Cost applies as written to States for NTNCWSs.	All	States with any model PWSs with service lines of lead or unknown content[3]	One Time
l) Provide translation technical assistance to PWS for public education materials				
The total hours per system multiplied by the system labor rate, plus the material cost. *(hrs_translate_phone_js*rate_js)+cost_translate _state*	Cost does not apply to NTNCWSs	Below AL	States providing model PWSs translation services either by telephone or written *p_translation* *p_translation_phone* *1-p_translation_phone_cws*	Once a year
The total hours per system multiplied by the system labor rate, plus the material cost. *(hrs_translate_ale_phone_js*rate_js)+cost_translate_ale_state*		Above AL		
The total hours per system multiplied by the system labor rate, plus the material cost. *(hrs_translate_ale_phone_js*rate_js)+cost_translate_ale_state*		Multiple ALEs		
m) Review public education certifications				

State Cost Per Activity for CWSs	State Cost Per Activity for NTNCWSs	Conditions for Cost to Apply to a State		Frequency of Activity
		Lead 90th – Range	Other Conditions[3]	
The hours per system multiplied by the State labor rate. *(hrs_pe_certify_quarterly_js*rate_js)*	The hours per system multiplied by the State labor rate. *(hrs_cert_outreach_annual_js*rate_js)*	Above AL	All States	Once per year[4]
n) Provide templates for updated public education materials for systems with a lead ALE[5]				
The hours per system multiplied by the State labor rate. *(hrs_ale_lang_temp_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	All States	One time
o) Review revised lead language for systems with a lead ALE[5]				
The hours per system multiplied by the State labor rate. *(hrs_ale_lang_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	All States	One time
p) Consult with CWS on other public education activities in response to lead ALE[5]				
The hours per system multiplied by the State labor rate. *(hrs_ale_consult_js*rate_js)*	Cost does not apply to States for NTNCWSs.	Above AL	All States	Once a year
q) Review plan for making filters available				
The hours per system multiplied by the State labor rate. *(hrs_temp_filter_plan_dev_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with any model PWSs with at least two lead ALEs	One time
r) Provide templates for systems with multiple lead ALEs				
The hours per system multiplied by the State labor rate. *(hrs_temp_persist_ale_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with any model PWSs with multiple ALEs	One time
s) Review outreach materials provided by systems with multiple lead ALEs				
The hours per system multiplied by the State labor rate. *(hrs_review_pe_persist_ale_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with any model PWSs with multiple ALEs	One time
t) Consult on filter program for systems with multiple ALEs				
The hours per system multiplied by the State labor rate. *(hrs_consult_temp_pou_js*rate_js)*	Cost applies as written to States for NTNCWSs.	Above AL	States with any model PWSs with multiple ALEs	One time

Acronyms: AL = action level; ALE = action level exceedance; CCR = consumer confidence report; CWS = community water system; LSL = lead service line; NTNCWS = non-transient non-community water system; PWS = public water system.

Notes:
[1] State oversight burden and costs for systems with LSLs with the exception of those associated with service line disturbances and implementing the POU program are included in Sections 4.4.4 and 4.4.5.1, respectively.
[2] The data variables in the exhibit are defined previously in this section with the exception of:

- *rate_js:* State hourly labor rate (Chapter 3, Section 3.3.11.2).

[3] PWSs with lead content or unknown lines are identified using the data variables and approach described in Chapter 3, Section 3.3.4. PWSs with multiple ALEs are described in Chapter 3, Section 3.3.5.2.
[4] States will review certifications quarterly for CWSs that are providing public education in response to a lead ALE. For modeling purposes, the State burden is estimated on an annual basis.
[5] States can discontinue these activities when the system no longer has a lead ALE for one monitoring period.

4.4.7 Summary of Estimated State Costs

The estimated monetized incremental annual State costs range from $27.7 million to $25.8 million in 2022 dollars at a 2 percent discount rate, under the low and high cost scenarios respectively (see Exhibit 4-1).

4.5 Costs and Ecological Impacts Associated with Additional Phosphate Usage

Adding phosphate to lead content piping creates a protective inner coating that can inhibit lead leaching. However, once phosphate is added to the PWS, some of this incremental loading remains in the water stream as it flows into WWTPs downstream. This generates treatment costs for certain WWTPs. In addition, at those locations where treatment does not occur, water with elevated phosphorus concentrations may discharge to water bodies and induce certain ecological impacts. Due to the fact that many water systems operate both the wastewater and drinking water systems, the EPA is evaluating the costs of additional phosphate usage for informational purposes. These costs to WWTPs and the downstream ecological impacts are not "likely to occur solely as a result of compliance" with the final LCRI, and therefore are not costs considered as part of the HRRCA under SDWA, section 1412(b)(3)(C)(i)(III).

4.5.1 Estimating the Costs of Increased Phosphorus Loadings

4.5.1.1 Incremental phosphorus loading to wastewater treatment plants

When PWSs add orthophosphate to their finished water for corrosion control purposes, some portion of the orthophosphate added will reach downstream WWTPs. To estimate the potential fate of the orthophosphate added at PWSs, the EPA developed a conceptual mass balance model, shown in Exhibit 4-190. The EPA applied this conceptual model to estimate the increase in loading at WWTPs (G in Exhibit 4-190), given an initial loading from corrosion control at water treatment plants (A in Exhibit 4-190). In applying the model, the EPA used the assumptions shown in Exhibit 4-191 regarding the other sources and losses of phosphorus (B through F in Exhibit 4-190).

Exhibit 4-190: Phosphorus Mass Balance Conceptual Model

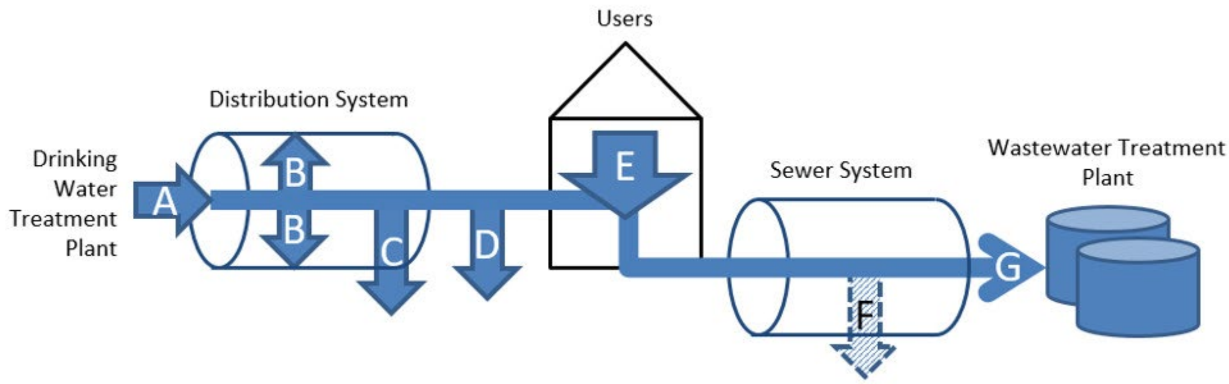

Exhibit 4-191: Summary of Assumptions Used in Estimating Phosphorus Loading Increase

Phosphorus Source or Loss	Assumptions Used
Loss Due to Incorporation in Distribution System Scale (B)	Assumed 0 percent based on data that P accounted for very little of the total mass of the scale formed during pipe loop testing (Benjamin et al., 1990); this assumption results in a conservative estimate of the incremental loading (*i.e.*, erring on the side of greater loading).
Loss to Distribution System Leaks and Breaks (C)	Average = 57.42 gpd/connection; Warm Climate = 53.64 gpd/connection; Cold Climate = 78.52 gpd/connection (Chastain-Howley et al., 2013).[1]
Loss to Outdoor or Other Uses (D)	Average = 30 percent (USEPA, 2008b); Warm Climate = 67%; Cold Climate = 22% (Mayer et al., 1999).[2]
Baseline Residential Loading (E)	Not used; relevant only to calculating total loading, not incremental loading.
Loss to Sewer System Leaks and Overflows (F)	Assumed 0 percent based on an estimate that that losses due to sewer overflows and misconnections are relatively small (Comber et al., 2013); this assumption results in a conservative estimate of the incremental loading (*i.e.*, erring on the side of greater loading).

Acronyms: P = phosphorus; gpd = gallons per day.
Notes:
[1] With respect to temperature, systems were classified as one of two categories depending on whether their location had an average annual temperature above or below 50°F (10°C).
[2] Warm climate value reflects the upper bound of outdoor use reported for cities in hot climates; cold climate value reflects the lower bound of outdoor use reported for cities in a cooler, wetter climates.

Specifically, the EPA adapted the conceptual mass balance model and the assumptions, shown in Exhibit 4-190 and Exhibit 4-191, respectively into Equation 1, and applied this equation in SafeWater LCR model to estimate the incremental WWTP loading resulting from adding upstream orthophosphate at each affected drinking water treatment plant.

Equation 1:

$$P_{incremental} = 0.775 \times Average\ Flow \times PO_4\ Dose - 0.061 \times Connections\ \times\ PO_4\ Dose$$

Where:

> $P_{incremental}$ = incremental WWTP loading in pounds per year measured as phosphorus
> Average Flow = drinking water system average flow in thousand gallons per year
> PO_4 Dose = incremental orthophosphate dosage in milligrams per liter (mg/L) as PO_4
> Connections = drinking water system number of connections

The equation above incorporates the colder climate assumptions from Chastain-Howley et al. (2013) and Mayer et al. (1999). Colder climates have greater losses to leaks and break, but a lower percentage of losses of outdoor use. Warmer climates show the opposite pattern. The equation uses the colder climate assumptions because, in combination, these assumptions result in an overall larger estimated loading increases than the warm climate or average climate assumptions.[156]

4.5.1.2 Incremental phosphorus removal costs at wastewater treatment plants

WWTPs could incur costs because of upstream orthophosphate addition if they have permit discharge limits for phosphorus parameters. Exhibit 4-192 shows data from the EPA's national pollutant discharge elimination system (NPDES) on the status of WWTPs with respect to permit limits for phosphorus.

Exhibit 4-192: WWTP Status with Respect to Phosphorus Discharge Permit Limits

Year	Total Number of WWTPs	Number of WWTPs with Phosphorus Permit Limits	Percentage of WWTPs with Phosphorus Permit Limits
2007	14,764	1,446	9.8%
2024	16,147	2,809	17.4%

Acronyms: WWTPs = wastewater treatment plants
Source: Based on national data from the EPA's Discharge Monitoring Report (DMR) "Water Pollutant Loading Tool" using search criteria limiting results to the phosphorus parameter group and WWTPs only (USEPA, 2024b). Note DMR Water Pollutant Loading Tool data is only available from 2007 onward.

As shown in Exhibit 4-192, the percentage of WWTPs with phosphorus limits has increased over time. From 2007 to 2024, in annual percentage rate terms, the growth rate in the percentage of WWTPs with phosphorus limits is 3.4 percent, calculated as follows:

$$\left(\frac{17.4\%}{9.8\%}\right)^{(1/17)} - 1$$

The EPA assumed this increase would continue as States transition from narrative to numerical nutrient criteria and set numeric permits limits, especially for impaired waters. The EPA applied the growth rate observed from 2007 to 2024 to estimate the anticipated percentage of WWTPs with phosphorus limits in future years. The EPA estimated the percentage anticipated for a given year using Equation 2. The EPA

[156] The derivation file "POTW P Loading Equations.xlsx" shows the detailed derivation of Equation 1 from the assumptions identified in Exhibit 4-191, including conversion factors.

calculated the estimated percentage for each year of the analysis and applied these percentages in the SafeWater LCR model as discussed below.

Equation 2:

$$\%_Y = \%_{2024} \times (1 + Rate)^{(Y-2024)}$$

Where:

Y = specific year being estimated
$\%_Y$ = percentage of WWTPs anticipated to have phosphorus discharge limits in year Y
$\%_{2024}$ = percentage of WWTPs with phosphorus discharge limits in 2024, or 17.4%
Rate = historical annual percent growth rate observed from 2007 to 2024, or 3.4%

Note that Equation 2 results in an estimated 61 percent of WWTPs with phosphorus discharge limits after 35 years.[157] Applied as the percentage of WWTPs that need to take treatment actions, this estimate is likely conservative particularly given the potential availability of alternative compliance mechanisms, such as, individual facility variance and nutrient trading programs.

The specific actions a WWTP might need to take to maintain compliance with its NPDES phosphorus limit will depend on the type of treatment present at the WWTP and the corresponding phosphorus removal provided (if any). Assuming a phosphorus permit limit of 1 mg/L (as Total P) – the most common limit observed in the source data for Exhibit 4-192 – it is likely that most of the WWTPs that already have phosphorus limits have some type of treatment to achieve the limit. Technologies for phosphorus removal from wastewater include the following (Jiang et al., 2004; USEPA, 2013; Rodgers, 2014; USEPA, 2021):

- enhanced biological processes (e.g., those that rely on phosphate accumulating organisms);
- chemical precipitation;
- adsorptive media;
- membrane processes;
- various emerging or innovative technologies; and
- treatment trains that combine one or more of the above.

Some treatment processes can accommodate incremental increases in influent loading and still maintain their removal efficiency. Examples include enhanced biological processes (assuming they are not limited by influent biological oxygen demand) and membrane processes. Such processes might not require significant adjustment to maintain their existing phosphorus removal efficiency, given an incremental increase.

Other treatment processes can require modification to their design or operation to maintain their removal efficiency in the face of an influent loading increase. A specific example is chemical

[157] The EPA estimated the percent of WWTPs with phosphorus discharge limits from 2027, the EPA's expected date of compliance, to 2061.

precipitation, in which the dosage of chemical(s) added (*e.g.*, ferric chloride, alum) is directly proportional to the influent phosphorus concentration. If influent loading increases, treatment trains relying on chemical precipitation would need to add more chemicals to maintain their efficiency of phosphorus removal.

Data are not available to identify the specific WWTPs that might be affected by increased orthophosphate loading or the burden associated with the phosphorus removal technologies in place at these WWTPs. Therefore, the EPA estimated costs by assuming that, on average, these costs would be similar to costs for a WWTP that uses ferric chloride for chemical precipitation to maintain 90 to 98 percent removal, and that has sufficient existing capacity to accommodate the increase in phosphorus loading.

Specifically, the EPA used the assumptions shown in Exhibit 4-193 to derive a unit cost of $5.44 in 2022 dollars per pound of phosphorus for removing incremental phosphorus. This unit cost includes the cost of additional chemical consumption and the operating cost of additional sludge processing and disposal.[158] This unit cost will overestimate costs for WWTPs that do not require significant operational adjustment to maintain their existing phosphorus removal efficiency. That would include, for example, WWTPs using enhanced biological processes that are not limited by biological oxygen demand. The unit cost, however, assumes that existing chemical feed, solids separation, and sludge management equipment has sufficient capacity. Therefore, it will underestimate costs for WWTPs that need to expand their treatment process capacity or install additional treatment to handle the increased loading.

Exhibit 4-193: Summary of Assumptions Used in Estimating Phosphorus Removal Unit Cost

Assumption	Value Used	Sources
Unit cost for ferric chloride	$0.11 per pound of bulk solution	Average of vendor bids in Fredrick County (2014) and Bi-state Commission (2014)[1], escalated to 2016 dollars using Bureau of Labor Statistics Producer Price Index for industrial chemicals
Ferric chloride solution concentration	40%	Consistent with vendor bids in Frederick County (2014) and Bi-state Commission (2014)
Ferric chloride solution bulk density	11.85 pounds per gallon	Consistent with 40% ferric chloride solution concentration; used to convert vendor bids in Bi-state Commission (2014)
Molar ratio required for phosphorus removal	2 moles iron per mole of phosphorus	A molar ratio of 1.5 to 2:1 (iron-to-phosphorus) can achieve an 80 to 98% reduction in soluble phosphorus per USEPA (2010)
Unit cost for sludge processing and disposal	$336 per dry ton	Average of actual sludge management costs reported in Stamford Water Pollution Control Authority (WPCA) (2013), City of Seabrook (2016), Sloan et al. (2008), Center for Rural Pennsylvania (2007), escalated to 2016 dollars using the consumer price index
Sludge production factor	10 grams per gram of phosphorus removed	USEPA (2010)

[158] The derivation file "POTW P Loading Equations.xlsx" shows the detailed derivation of this unit costs from the assumptions identified in Exhibit 4-191 including conversion factors.

Note: [1] The sources used are tabulations of bids received by water utilities from vendors bidding on contracts to provide an annual supply of treatment chemicals. Using these sources ensures that the cost estimate reflects prices charged to utility customers for typical quantities of ferric chloride solution with concentrations and other specifications appropriate to the water treatment application the EPA is modeling.

Finally, the costs a WWTP could incur depend on the magnitude of the loading increase relative to the specific WWTP's effluent permit limit. WWTPs whose current discharge concentrations are closer to their limit are more likely to have to take action. However, WWTPs whose current concentrations are well below their limit could incur costs if, for example:

1. They are currently achieving their limit using a P removal technology.
2. The P removal provided by that technology is significant.
3. The P removal achieved by technology is sensitive to incremental P loading increases (e.g., chemical phosphorus removal).

Furthermore, future phosphorus limits could be more stringent than existing limits.

Therefore, the EPA assumed that any WWTP with a discharge limit for phosphorus parameters could incur costs. Accordingly, in calculating costs in the SafeWater LCR model, the EPA used the anticipated percentage of WWTPs with phosphorus discharge limits, calculated as shown in Equation 2, as the likelihood that incremental orthophosphate loading from a drinking water system would reach a WWTP with a limit. The EPA combined this likelihood and the unit cost estimated above with incremental phosphorus loading to calculate incremental costs to WWTPs for each year of the analysis period. This calculation is equivalent to that shown in Equation 3.

Equation 3:

$$\boldsymbol{Incremental\ Cost_Y} = \%_{\boldsymbol{Y}} \times \boldsymbol{Unit\ Cost} \times \sum \boldsymbol{P_{incremental}}$$

Where:

> Incremental $Cost_Y$ = incremental cost to WWTPs in year Y
> $\%_Y$ = percentage of WWTPs anticipated to have phosphorus discharge limits in year Y, calculated as shown in Equation 2
> Unit Cost = incremental cost of treatment per pound of phosphorus, or $5.44 per pound
> $\sum P_{incremental}$ = incremental WWTP loading in pounds per year measured as total phosphorous from all affected drinking water treatment plants

As shown in Exhibit 4-1, the estimated incremental annualized cost that WWTPs will incur to remove additional phosphorous associated with the final LCRI ranges from $120,000 to $300,000 in 2022 dollars at a 2 percent discount rate.

4.5.2 Ecological Impacts of Phosphorus Loadings

The ecological impacts of increased phosphorous loadings are highly localized: total phosphorus loadings will depend on the amount and timing of the releases, characteristics of the receiving water

body, effluent discharge rate, existing total phosphorus levels, and weather and climate conditions. Unfortunately, detailed spatially explicit information on effluents and on receiving water bodies does not exist in a form suitable for this analysis. Rather, to evaluate the potential ecological impacts of the rule, the EPA developed approximate, national-level total phosphorous loading estimates, and evaluated the significance of the loadings compared to other phosphorous sources in the terrestrial ecosystem.

4.5.2.1 Incremental total phosphorus loadings in water bodies

The SafeWater LCR model, using Equation 1 described above, estimated the total incremental phosphorus loadings to reach WWTPs under the final LCRI. Exhibit 4-194 provides the estimated total and increase in phosphorus loadings nationally for selected years after the LCRI goes into effect under the low scenario. Exhibit 4-195 provides the same information for the high scenario. If the LCRI were not to go into effect, by Year 5, under the 2021 LCRR, PWSs would have begun compliance with the 2021 LCRR and CCT treatment would be increased. This is why the incremental increase in loadings associated with the LCRI are negative in Year 5.

Exhibit 4-194: Estimated Nationwide Annual Phosphorus Reaching WWTPs after Implementation of the LCRI under Low Cost Scenario

	Thousands of Pounds of Phosphorous				
	Year 0	**Year 5**	**Year 15**	**Year 25**	**Year 35**
2021 LCRR	6,279	6,819	6,970	7,113	7,255
Final LCRI		6,279	7,512	7,680	7,775
Increase Under 2021 LCRR		540	691	835	976
Increase Under Final LCRI		-	1,234	1,401	1,497
Incremental Increase over 2021 LCRR		(540)	542	567	520

Acronyms: LCRR = Lead and Copper Rule Revisions; LCRI = Lead and Copper Rule Improvements; WWTPs = wastewater treatment plants.

Exhibit 4-195: Estimated Nationwide Annual Phosphorus Reaching WWTPs after Implementation of the LCRI under High Cost Scenario

	Thousands of Pounds of Phosphorous				
	Year 0	**Year 5**	**Year 15**	**Year 25**	**Year 35**
2021 LCRR	6,173	7,275	7,522	7,769	7,995
Final LCRI		6,173	8,178	8,450	8,621
Increase Under 2021 LCRR		1,102	1,349	1,596	1,822
Increase Under Final LCRI		-	2,005	2,277	2,448
Incremental Increase over 2021 LCRR		(1,102)	656	681	626

Acronyms: LCRR = Lead and Copper Rule Revisions; LCRI = Lead and Copper Rule Improvements; WWTPs = wastewater treatment plants.

The EPA then adjusted these values for the expected treatment of influent at WWTPs. Based on the Clean Watersheds Needs Survey, about 50 percent of facilities (36 percent of flow) have secondary water treatment and 34 percent of facilities (57 percent of flow) have greater than secondary treatment (USEPA, 2012a) that will reduce the amount of phosphorus reaching waterbodies. Estimates suggest that secondary treatment may remove 20 to 75 percent of total phosphorus and greater than secondary treatment may remove 90 to 95 percent (Metcalf and Eddy, 2003; Grady, 2011; USEPA, 2015b) of the

phosphorus reaching waterbodies. Thus, the EPA conservatively estimates that 36 percent of flow will experience a 20 percent reduction in total phosphorus and 57 percent of the flow will experience a 90 percent reduction of total phosphorus, generating a flow-weighted average reduction in total phosphorus levels of about 58.5 percent. Using these assumptions, the EPA estimated the amount of total phosphorus that is expected to enter receiving waterways nationally as a result of the 2021 LCRR and final LCRI under the low cost assumptions (Exhibit 4-196) and high cost assumptions (Exhibit 4-197).

Exhibit 4-196: Estimated Nationwide Annual Phosphorus Reaching Waterbodies after Implementation of the LCRI under Low Cost Scenario

	Thousands of Pounds of Phosphorous				
	Year 0	**Year 5**	**Year 15**	**Year 25**	**Year 35**
2021 LCRR	2,605	2,829	2,892	2,951	3,010
Final LCRI		2,605	3,116	3,186	3,226
Increase Under 2021 LCRR		224	287	346	405
Increase Under Final LCRI		-	512	581	621
Incremental Increase over 2021 LCRR		(224)	225	235	216

Acronyms: LCRR = Lead and Copper Rule Revisions; LCRI = Lead and Copper Rule Improvements.

Exhibit 4-197: Estimated Nationwide Annual Phosphorus Reaching Waterbodies after Implementation of the LCRI under High Cost Scenario

	Thousands of Pounds of Phosphorous				
	Year 0	Year 5	Year 15	Year 25	Year 35
2021 LCRR	2,561	3,018	3,120	3,223	3,317
Final LCRI		2,561	3,393	3,505	3,576
Increase Under 2021 LCRR		457	559	662	756
Increase Under Final LCRI		-	832	945	1,015
Incremental Increase over 2021 LCRR		(457)	272	282	260

Acronyms: LCRR = Lead and Copper Rule Revisions; LCRI = Lead and Copper Rule Improvements.

To put these phosphorus loadings in context, estimates from the United States Geological Survey (USGS) SPAtially Referenced Regression On Watershed attributes (SPARROW) model suggest that anthropogenic sources deposit roughly 750 million pounds of total phosphorus per year (USEPA, 2019b). Under the high cost scenario, this additional phosphorous loading is small, about 0.03 percent (260,000/ 750,000,000) of the total phosphorous load deposited annually from all other anthropogenic sources. Note that the EPA model assumes that once CCT is installed or re-optimized phosphate use remains constant over the remainder of the period of analysis. Because most CCT implementation is carried out prior to complete LSL removal and the model does not allow for reductions in the use of phosphate after systems remove all their lead content service lines, the EPA's CCT cost estimates and phosphorus loading estimates to both WWTPs and receiving waterbodies may be overestimated.

National average load impacts may obscure significant localized ecological impacts. The existing data do not allow an assessment as to whether this incremental load will induce ecological impacts in particular areas; however, localized impacts may occur in water bodies without restrictions on phosphate loadings, or in locations with existing elevated phosphate levels. The next section describes potential ecological impacts that could occur in receiving water bodies.

4.5.2.2 Ecological impacts of potential increases in phosphate loadings

Aquatic organisms rely on some amount of essential nutrients, including nitrogen and phosphorous, for growth and survival. In many aquatic ecosystems, phosphorous is the limiting nutrient (USEPA, 2016a). As a limiting nutrient, phosphorous frequently controls the growth rate of phytoplankton, bacteria, and algae (USEPA, 2016a). Discharging excess phosphorous into waterbodies can therefore stimulate excess plant and algae growth and, under certain circumstances, create undesirable ecological impacts. Phosphorous in the environment can persist longer periods of time relative to nitrogen. Sediment-bound phosphorous can persist unchanged and, when re-suspended back to the water column, can pose renewed threats. Localized conditions will enhance or dissipate phosphorous problems.

Nutrient pollution causes eutrophication—that is, excessive plant and algae growth—in lakes, reservoirs, streams, and estuaries throughout the United States. According to the EPA's 2012 National Lakes Assessment, 40 percent of lakes in the United States have excess phosphorus (USEPA, 2016a). The EPA's 2008-2009 National Rivers and Streams Assessment found that 40 percent of river and stream miles have nutrient pollution (USEPA, 2016b). The excessive growth of algae and phytoplankton can reduce water clarity and light penetration, reducing the production of benthic plant growth (Lehtiniemi et al., 2005). The reduction of benthic plants alters or destroys habitat that may be required or utilized by other organisms, such as fish, benthic macroinvertebrates, amphibians, and more. Predators reliant upon vegetation may have reduced predation success (Lehtiniemi et al., 2005). The excessive growth of algae and phytoplankton eventually leads to mass mortality events, in which these microorganisms die off rapidly. The decomposition of the additional biomass consumes oxygen in the water, creating hypoxia, a state of low dissolved oxygen. Sufficiently low to no oxygen states can create dead zones, or areas in the water where aquatic life cannot survive. Studies indicate that eutrophication can decrease aquatic diversity for this reason (*e.g.*, Dodds et al., 2009).

Eutrophication may also stimulate the growth of harmful algal blooms (HABs), or over-abundant algae or cyanobacteria populations. Algal blooms can seriously harm the aquatic ecosystem by blocking sunlight and creating diurnal swings in oxygen levels as a result of overnight respiration. Such conditions can starve and deplete aquatic species. In addition, rapid photosynthesis may consume dissolved inorganic carbon and elevate pH (Chislock et al., 2013). Altered pH levels in aquatic ecosystems can impact the chemosensory abilities of aquatic species, potentially altering their behaviors and interactions with other species (Turner & Chislock, 2010). Certain types of phosphorous-fueled cyanobacterial blooms may produce toxins to both humans and aquatic life. These toxins include microcystins (liver toxins) and neurotoxins. This issue is particularly prevalent in lakes or other slow-flowing water bodies. For additional information on the human health risks when HABs result in drinking water cyanotoxin exposure and the management tools available to PWSs see The EPA website: https://www.epa.gov/ground-water-and-drinking-water/managing-cyanotoxins-public-drinking-water-systems. HAB events have also directly or indirectly contributed to fish kill events by causing the absorption or ingestion of toxins, or by creating conditions of limited sunlight and oxygen (Glibert et al., 2005). In addition to lethal impacts on aquatic organisms, toxins produced by HABs can harm terrestrial wildlife and livestock that are exposed to toxins in sufficient levels (Backer, 2002; Chislock et al., 2013). Toxins are capable of bioaccumulating and transferring to higher trophic levels, killing birds, mammals, and other wildlife that consume prey contaminated with toxins (Su et al., 2020). In marine environments, HABs can impact or destabilize cultivated stocks of finfish or shellfish, potentially destroy benthic habitat, and contribute to marine fish kills (Cloern, 2001). Overall, the effects of eutrophication

and HABs can alter higher trophic level communities (Jeppesen et al., 1997). Changes to community composition can potentially degrade emergent ecosystem properties and impact overall ecosystem function.

Finally, an increase in phosphorus loadings can lead to significant economic impacts and undesirable aesthetic impacts. Research estimates significant economic costs of eutrophication, including recreation and angling costs and property value costs (Dodds et al., 2009). Aesthetic impacts such as reduced water clarity and an increase in foul-smelling odors may also arise, making water unsuitable for recreational activities such as swimming, boating, and fishing (Dodds et al., 2009). Phosphorus additions can also reduce the non-use (e.g., option, existence or bequest value) value of the water resource.

The seasonal Gulf of Mexico dead zone demonstrates a powerful example of the negative ecological impacts that result from excessive nutrients. The Gulf of Mexico dead zone is the second largest in the world, and results from the inflow of nutrients from the Mississippi River basin (Costa et al., 2023; Louisiana Universities Marine Consortium, 2018). The dead zone begins in later summer, when the water column stratifies, and the benthic water column layer becomes deprived of dissolved oxygen (Costa et al., 2023; Louisiana Universities Marine Consortium, 2018). The dead zone persists for months until weather changes provide stronger mixing of water and break up the layer stratification (Louisiana Universities Marine Consortium, 2018). As of 2023, the five-year average size of the dead zone measures just over 4,300 square miles (National Oceanic and Atmospheric Administration, 2023). The hypoxic area represents millions of acres of possibly unsuitable habitat for some wildlife (National Oceanic and Atmospheric Administration, 2023). While some species can leave the area as the hypoxic zone forms, others cannot escape it and become stressed or die. The displacement or removal of species can impact the trophic interactions within an ecosystem, creating impacts to other species, such as predators. Models have demonstrated the ability of the dead zone to lower the reproductive capacity, increase mortality, and alter the diet of finfish, as well as alter habitat use of shellfish (Craig & Crowder, 2005; National Oceanic and Atmospheric Administration, 2020; Rose et al., 2018).

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5 Benefits Resulting from the Lead and Copper Rule Improvements

5.1 Introduction

Lead is a highly toxic pollutant that can damage neurological, cardiovascular, immunological, developmental, and other major body systems (USEPA, 2024a). Children are at higher risk from the effects of lead than adults, due to differences in their stage of brain development, body weight, physiology, and behavior (USEPA, 2024a).

Although copper is essential to normal physiology, excess intake is also associated with several adverse health outcomes (NRC, 2000). Most commonly, excess exposure to copper leads to gastrointestinal symptoms such as nausea, vomiting, and diarrhea (NRC, 2000). In children with genetic disorders or predispositions to accumulate copper, chronic exposure to non-physiological levels of this element can result in liver damage.

Due to these serious adverse effects, the Lead and Copper Rule improvements (LCRI) are expected to yield significant health benefits, which are described in this chapter and associated appendices. Some of these benefits are expressed in monetary terms. Section 5.2 presents modeling results and limitations of the analysis on the reduction of lead levels in water as a result of two interventions: 1) the removal of lead service lines (LSLs) and 2) the introduction of corrosion control treatment (CCT). Section 5.3 discusses the assignment of drinking water concentrations to public water system (PWS) populations and associated limitations. Sections 5.4, 5.5, and 5.6 focus on the methodology and assumptions for quantifying the benefits of line removal and corrosion control interventions. Section 5.6.2 presents the results of the quantified and monetized benefits. Section 5.7 provides a summary exhibit and outlines the identified limitations and uncertainties in the benefits analysis and how they might affect the estimated values presented in the chapter. Section 5.8 discusses the nonquantifiable benefits associated with the regulatory requirements of the final LCRI. Section 5.9 discusses the potential climate disbenefits from the operation of optimal corrosion control treatment (OCCT) at drinking water treatment facilities and the use of construction and transport vehicles in the replacement of lead and galvanized requiring replacement (GRR) service lines.

The United States Environmental Protection Agency (the EPA or the agency) quantitatively estimated benefits using low and high benefit scenarios. The low and high scenarios are driven by the number of PWSs that will exceed the lead action level (AL) under the revised tap sampling requirements of the final LCRI.

The low and high scenarios are also defined by the concentration-response functions that characterize how reductions in blood lead levels (BLLs) (caused by changes in lead exposure) translate into avoided intelligence quotient (IQ) reductions, cases of attention deficit hyperactivity disorder (ADHD), and cardiovascular disease (CVD) premature mortality. The specific concentration-response functions that define the low and high scenarios are as follows:

- For IQ in children Lanphear et al. (2005, errata 2019) is used for the high scenario estimate and the low scenario estimate is based on Crump et al. (2013). See Section 5.5.1.
- For avoided cases of ADHD in children the high scenario estimate is based on Froelich et al (2009) and the low estimate is based on Ji et al. (2018). See Section 5.5.3.

- For CVD premature mortality in adults the high scenario estimate is based on Lanphear et al. (2018) and the low scenario is based on Aoki et al. (2016). See Section 5.5.7.

Note that the fourth category of quantified benefits, reductions in lower birth weight in infants due to mother's lead exposure, is estimated with a single function in both the high and low scenarios based on Zhu et al. (2010). See Section 5.5.5.

The third factor that differentiates the estimated range of benefits is the use of low and high valuations for the ADHD cost of illness, as described in Section 5.5.4.

Numerous other adverse health effects are associated with exposure to lead, many at low doses. Appendices D and E contain additional information on the effects of lead and copper exposure. Appendix D provides more detailed information on the six categories of health effects that the EPA and the National Toxicology Program (NTP) have deemed to be associated with lead exposures: cardiovascular effects, renal effects, reproductive and developmental effects, immunological effects, neurological effects, and cancer. The adverse health effects associated with copper are summarized in Appendix E. At sufficient exposures, copper has been associated with gastrointestinal effects in the general population and with liver toxicity in susceptible individuals (e.g., individuals with Wilson's Disease). The EPA anticipates that these adverse health effects will also be reduced due to the rule, but they are not explicitly quantified in this analysis. Appendix F presents an additional sensitivity analysis on the valuation of IQ estimates, for children up to age 7.

5.2 Baseline and Post-Rule Drinking Water Lead Exposures

This section discusses methods for estimating baseline (i.e., current) and post-rule exposures to lead through drinking water. The EPA used the lead concentration of water drawn from the kitchen tap to estimate exposure through drinking water under each of the potential CCT and LSL[159] scenarios. No national level dataset exists that incorporates sufficient detail regarding these scenarios, so the EPA obtained datasets from multiple sources. This combined dataset has limitations, such as varying sampling methods and locations. The EPA managed these limitations, first through data cleaning, coding, model fitting, and selection. The EPA subsequently used this model to produce a simulated dataset of lead concentrations under the different scenarios used to control for variation in the combined dataset to the extent possible.

To estimate drinking water lead concentrations at the tap, the EPA obtained and assessed tap water lead concentration data from utilities, the EPA's regional offices and Office of Research and Development, and authors of published journal articles. These data include information about sampling methods, locations, dates, and LSL status. The EPA further divided the lead tap concentration records into CCT categories based on the locations and dates of samples, and known treatment and finished water quality histories. The EPA combined these sources to produce a dataset (described in Section 5.2.1) for further analysis (Section 5.2.2). The EPA then fit a model to these data and subsequently used

[159] Note that the EPA does not have sampling data from galvanized lines previously downstream of a lead line and therefore requiring replacement (GRR). In the estimation on benefits the EPA assumes that water lead levels from both LSLs and GRRs are equivalent.

the fitted model to simulate representative lead concentrations in PWSs. The resulting simulated dataset of the tap sample lead concentrations was used to estimate BLLs (as described in Section 5.4).

Ideally, to determine the potential lead tap concentrations under the various CCT and LSL scenarios, a researcher would analyze the variation of lead concentrations in tap samples nationwide across the defined scenarios. However, due to the nature of the available data, the EPA's lead concentration data were collected from different locations, with different methods, over multiple decades, and for different purposes. Therefore, the interpretation of what is driving the tap sample lead concentration variation within and across CCT and LSL scenarios becomes complicated. A good deal of the variation in the lead concentration data may be due to the use of different sample collection methodologies and unequal numbers of repeated samples at the same time and place. Therefore, rather than using summary statistics from the original data directly, the EPA undertook a detailed analysis to understand the effects of the LSL and CCT scenarios while statistically controlling for data collection artifacts that may have contributed to variation in measurements of lead concentration at the tap (Sections 5.2.1).

The EPA implemented the following analyses of the aggregate dataset and adjusted the data to enhance the quality. After compiling the water lead concentration dataset, the EPA statistically modeled the relationship of LSLs and CCT with lead concentrations at the tap (Section 5.2.2). This model also related lead concentration to the amount of water that had flowed from the tap after stagnation. Additionally, the EPA incorporated methods to estimate the effects of different water systems, residences, and sampling events at the same residence. The EPA incorporated terms into the model for the amount of water, city water system, and residence to control for data collection artifacts from different studies, as most cities were linked to a single study per city water system (Exhibit 5-1). The EPA similarly controlled for differences among sampling events in the same homes and within studies.

The fitted model demonstrates that LSL status and CCT both affect lead concentration at the tap. The presence of an LSL is associated with higher lead concentrations. In homes with any LSL (full or partial), improved CCT is associated with lower lead concentrations. CCT has less of an effect in homes with no LSL present. Assessment showed that seven combinations (i.e., scenarios) of LSL status and CCT had predicted concentrations that were sufficiently distinct to warrant separate predictive modeling. These seven scenarios were used to produce estimates of drinking water concentration. The EPA also used information from the statistical model to simulate estimates of lead concentration for ten sequential one-liter volumes drawn from a household tap after stagnation (Section 5.2.3). Given recent findings (Urbanic et al. 2022) from the comparison of composite samples, which approximate lead exposure given water use patterns at a residence, and profile samples, where a volume weighted average lead concentration was calculated, at sites in two cities, the agency chose to use a volume weighted average lead concentration calculated using data from the first 10 liters of profile data in approximating exposure at the tap for this final LCRI benefits analysis. Throughout this document, the EPA uses standard terminology to describe LSL status and CCT implementation. "LSL" indicates lead service lines are present, "partial LSL" indicates some presence of lead in service lines (i.e., partial replacement), and "no LSL" indicates no LSLs. For CCT, "none" indicates no CCT, "partial" represents systems that have some CCT in place but are not optimized, and "representative" indicates a water chemistry that exemplifies the optimal CCT currently in use (which can include some combination of higher phosphate values or optimized pH levels). Water lead concentration prediction intervals overlapped completely for all CCT scenarios in homes with no LSL (described in Section 5.2.3), so "combined" indicates pooled CCT estimates representing all three states of CCT in non-lead service line households. Further details are

provided in Section 5.3. Additionally, all water modeling was conducted using data based on the presence or absence of LSLs (Sections 5.2.1, 5.2.2, and 5.2.3). Galvanized service lines requiring replacement (GRR) are also considered in the rule, and these are assigned a water concentration based on the results of the LSL analysis (see Section 5.2.4).

5.2.1 Drinking Water Lead Concentration Profile Data

The EPA combined data from multiple sources for use in estimating lead concentration at the tap based on LSL status and CCT implementation. For the LCRI, the EPA updated the analysis done for the 2021 LCRR with new data. In order to produce these updated values, we incorporated new data from the city of Clarksburg, WV collected in October of 2021. This dataset was collected in fall to winter 2021, and each sampling event consisted of 19 profile samples with 17 liters of water in each profile. The Clarksburg data included 19 unique residences with lead lines, as well as 11 that have no known LSL history and had copper lines at the time of sampling. The locations with no known LSL history and copper lines were excluded. Ten of the 19 residences with LSL were sampled during two separate sampling events. One of the sampling events was conducted directly after lead service line replacement (LSLR) and could not be included due to the potential for elevated lead concentrations directly following LSLR (McFadden et al. 2011, Sandvig et al. 2008).

The EPA also considered including datasets from Cleveland, OH, Chicago, IL, Kalamazoo, MI, Parchment, MI, Flint, MI, Galesburg, IL, and Sebring, OH. These data were collected between 2016 and 2021 but not included in the original analysis. These other datasets had some data availability and study design issues and therefore could not be included. The EPA's mixed model used for water concentration modeling estimates random terms for multiple sampling events at the same location. Therefore, when no locations in a city were sampled over multiple sampling events at different times, the lack of repeated measurements caused issues in fitting the mixed model. This issue affected the Cleveland, Flint, Chicago, Kalamazoo, Parchment, and Galesburg datasets. The other datasets were also missing information regarding LSL and/or CCT status and history. Locations in Flint had previously undergone only partial LSLR on the private side, but dates of that LSLR were not available, and the private-side replacements often affected long portions of the service line. Chicago had no information regarding service line material or replacement status associated with lead samples. The Sebring dataset held multiple sampling events for three addresses taken while CCT optimization was occurring. While these locations had LSLs at the beginning of the study, some Sebring locations underwent LSLR over the optimization period, or had previous partial replacements. The dates for these changes in LSL status were not given relative to the sampling dates. Additionally, the structure of the dataset suggested the non-detects may have been replaced by a value of 0.005 mg/L (the practical quantitation limit for lead), but some values were lower than this. Due to the combination of the lack of clarity regarding the LSLR history and non-detect usage, we excluded these three locations. In addition to having only single samples per location with no repeated sampling events, the Kalamazoo and Parchment locations sampled were not clearly associated with any specific water system. This made it difficult to determine CCT status on any given date, and also caused uncertainty regarding which system to assign observations to for estimation of the system-level effect. Finally, CCT information about Galesburg was incomplete for the time of the study, so the Galesburg data were not included in the updated regression.

Including the material from Clarksburg, WV, the data used in updating the regression analysis represented 18,571 samples collected from 1,657 homes in 16 cities representing 15 city water

systems[160] across the United States and Canada (Exhibit 5-1). Data included lead concentrations and information regarding LSL status, location, and date of sample collection from seven municipal water systems in the United States and eight in Canada between 1998 and 2021. The EPA chose to include data from Canada because data from the United States were limited or nonexistent for certain types of sites, such as sites without corrosion control after LSL removal or homes with LSLs but no CCT. Overall, geometric mean concentrations were similar in the two countries (described in Section 5.2.1.2), although there were not enough overlapping data to compare the geometric means for all combinations of LSL and CCT status.

Exhibit 5-1: Tap Water Lead Concentration Sample Data: Source Citations, City Water System, LSL and CCT Status Represented in the Data Source, and Number of Individual Sample Bottles per Source*

Citation of Data Source[a]	City Water System Represented by Data Source[b]	LSL Status of Samples by Data Source	CCT Status by Data Source	Total Number of Samples by Data Source[c]
Camara et al., 2013	Halifax, NS	LSL, No LSL, Partial	Partial[d]	16
The Cadmus Group, Inc., 2007	Washington, D.C.	LSL, Partial	Partial	969
Campbell, 2016	Ottawa, ON	LSL, Partial	Representative	5,149
Clarksburg, 2021	Clarksburg, WV	LSL	Partial	532
Commons, 2011	Providence, RI [d]	LSL, Partial	Partial	169
Commons, 2014	Providence, RI [d]	Partial	Partial	40
Craik, 2016	Edmonton, AB	LSL, No LSL, Partial	None	967
Del Toral et al., 2013	Chicago, IL	LSL	Representative	695
Del Toral, 2016	Flint, IL	LSL, No LSL	Partial, Representative	3,678
Deshommes et al., 2016	Montreal, QC	LSL, No LSL, Partial	None	630
Desmarais et al., 2015	London, ON	LSL, Partial	None	1,430
EPCOR Water Services, 2008	Edmonton, AB	LSL	None	107
Hayes et al., 2014	Calgary, AB	LSL, No LSL	None	144
Muylwyk, 2016	Guelph, ON	LSL, No LSL, Partial	None	1,039
O'Brien & Gere, 2015	Providence, RI [d]	LSL, Partial	Partial	158
DC Water, 2016	Washington, D.C.	LSL, No LSL, Partial	Representative	1,391
Schock, 2016	Sebring, OH	LSL	Partial, None	825
Estes-Smargiassi et al., 2006	Boston, MA	LSL, Partial	Representative	50
Swertfeger et al., 2006 Desmarais et al., 2015 Triantafyllidou et al., 2015	Cincinnati, OH	LSL, No LSL, Partial	Partial, Representative	582

* The full analytical dataset is available in the docket for the rule under docket number EPA-HQ-OW-2022-0801 at https://www.regulations.gov, file: "2023-05-25_PbProfileAbt_FittedModels_DataLCR.xlsx."
[a] Some of these citations contain data from multiple studies, including previously published and unpublished data.
[b] Some of these cities represent places where corrosion control levels changed in the same location over time, or where LSLs were replaced.

[160] This number included two cities, Providence and Cranston in Rhode Island, which have been re-categorized as a single city water system to reflect their shared water source. Cranston is a consecutive system and receives its water from Providence.

[c] The number of samples is the number of individually measured water samples (*i.e.*, bottles). The number of profile sampling events is shown in Section 5.2.1.2.
[d] Cincinnati before 2006; Halifax and Providence/Cranston water systems were revised from "Representative" CCT to "Partial" CCT based on public comment as well as peer review of Stanek et al., 2020. These changes were applied to all of the following figures and tables.

5.2.1.1 Lead Concentration Profiles

Most data sources contained series, or "profiles," of water samples that were drawn from the same kitchen tap after a whole-house stagnation period. Exhibit 5-2 shows the general sampling process as it relates to portions of home plumbing, service line, and the connection to the city water main. In general, the EPA does not believe that the water in water mains in the United States contain lead.[161] Water can become contaminated during stagnation by lead leaching from LSL and home plumbing containing lead. When the tap is turned on and water is drawn after stagnation, lead concentrations may show peaks based on the amount and location of lead-bearing plumbing materials in contact with the water between the tap and the water main. In other words, there may be considerable variation in lead concentration measured in water samples drawn from a tap after a stagnation period; this variation decreases as non-stagnant water from the main reaches the tap. Taps have different flow rates, and the volume of water rather than the length of time was used to account for the position in tap sampling series.

A "complete" profile includes consecutive measurements taken from the tap, through any peaks in lead concentration, to a point where the lead concentration in water shows little to no further decrease. Exhibit 5-3 displays an example of a complete profile of lead in tap water. Most of the primary data sources, representing the 15 city water systems, contain profiles of varying levels of completeness (Exhibit 5-4 and Exhibit 5-5). However, the sources also incorporate data regarding sample volume and position in the profile series for each individual sample. The EPA used this information to calculate the "profile liter" variable (Section 5.2.2) to control for variability in differences in profile position and volume among samples within the fitted model and the following simulation.

Although these data represent a large portion of available data, they may not be nationally representative with respect to the following factors: water chemistry and corrosion control practices; service line length, materials, and scales; size, type, and location of internal piping and lead sources; the type and number of residences with LSLs; and the relative contribution of particulate lead. These data also do not incorporate water usage patterns within a home that could affect exposure, such as dishwasher use, laundry, and showering. Some usage patterns may flush water lines and reduce exposure to stagnant water through drinking and cooking. The following sections describe how the EPA cleaned the data; coded and fit models to control for some of the variation in the existing dataset due to water system, site, and sampling methods; and produced simulated values for use in BLL estimation.

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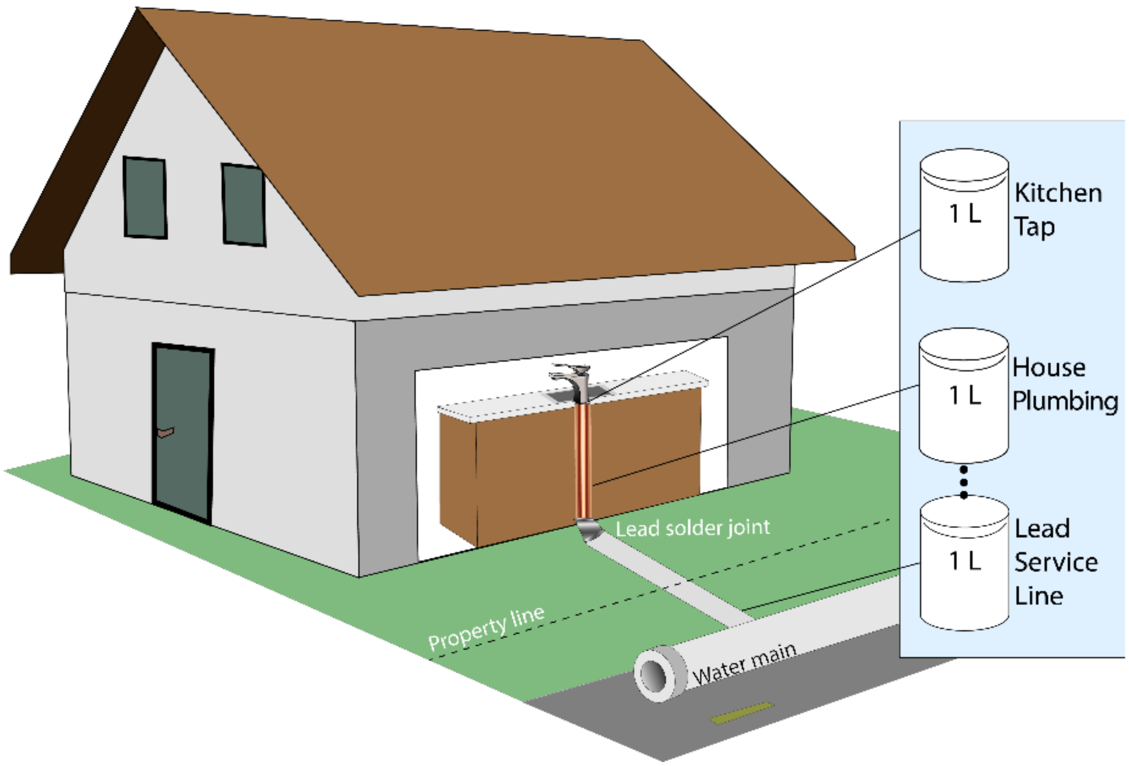
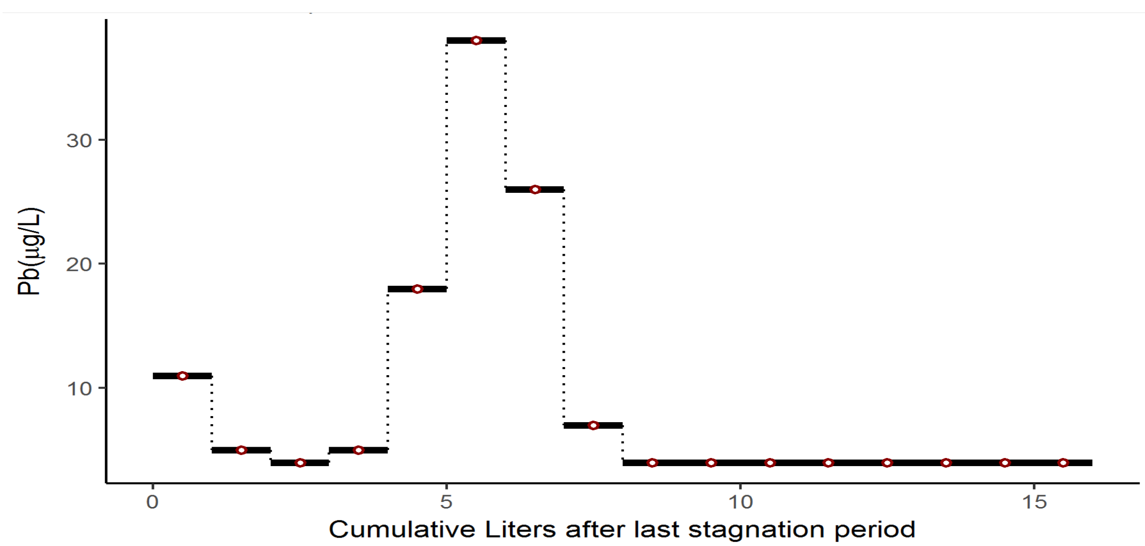
[161] The EPA does not believe that there are lead water mains in the country. Water mains are typically six to 16 inches in diameter whereas service lines have a smaller diameter. The common water main materials include ductile iron, PVC, asbestos cement, HDPE, and concrete steel (Folkman, 2018). Lead service lines are two inches or less in diameter (LSLR Collaborative, n.d.).

Exhibit 5-2: Diagram Showing Plumbing Where Water Can Become Contaminated with Lead



This exhibit shows a profile of multiple, one-liter samples. Although mixing occurs, the earliest samples drawn after stagnation are representative of water in fixtures and home plumbing, while those that follow represent water from service lines, and finally, the water main.

Exhibit 5-3: Example of a Complete Consecutive Liter Profile of Lead Concentrations in Tap Water from a Location with a Lead Service Line



Source: Data from Commons (2011).

Note: Lead concentration is elevated in the first liter, lower in the second through third liters, highest from the fourth to sixth liters, and zero after the seventh liter. Red dots represent lead (Pb) concentration plotted at the midpoint of the cumulative volume of each sample ("profile liter"). The widths of the horizontal bars indicate the total volume of each sample. The samples shown in this figure were from a residence with an LSL and representative CCT in Providence, RI (Commons, 2011).

5.2.1.2 Data Cleaning

The EPA cleaned and combined the datasets listed in Exhibit 5-1 by removing duplicate records, records without water lead concentration values, and records that did not meet the criteria for inclusion in the profile dataset. Only samples of known volume after stagnation periods of at least 30 minutes were included in the profile data. Samples that were collected immediately after flushing events were generally excluded, unless the flushing volume had also been recorded. Samples from known locations other than kitchen taps, such as exterior spigots, were also excluded from the data. Concentration records for homes that underwent partial or full LSLRs occasionally included a number of post-replacement sampling profile series collected over several months to years after service line replacement. In these cases, lead concentrations typically declined over subsequent sampling periods, as residual lead in household plumbing was flushed. As there were too few cases of this post-replacement sampling in the dataset to incorporate this effect in models, only the last profile after LSLR was included in the analysis dataset. If elapsed time after an LSLR could not be determined for the post-replacement samples, all samples after LSLR were included, which may increase the observed variability in estimates of concentration after LSLR. An outlier for a site in Washington, D.C., was removed after confirming with the data provider (personal communication, DC Water, May 2017) that the sample was unlikely to be representative of concentrations in most homes. Other cases with concentrations higher or lower than expected for particular CCT and LSL categories did not have clear reasons to exclude them, such as suspect sample collection conditions or obvious particulate lead. These values were included for the integrity of the dataset.

Before producing summary statistics or fitting models using the profile dataset, the EPA set all known lead non-detects to 0.1 µg/L,[162] and then log-transformed the lead concentrations. The summary tables in Exhibit 5-4 and Exhibit 5-5 reflect the data cleaning steps.

Exhibit 5-4 and Exhibit 5-5 show the geometric mean, standard deviation (SD), and maximum lead concentration for each combination of CCT and LSL status in the cleaned data after log-transformation of lead concentrations for all 18,571 samples included in the model. Additional details regarding data cleaning and categorization for specific datasets are contained in Appendix F, Section F-1 of the *Economic Analysis for the Final Lead and Copper Rule Revisions* (hereafter referred to as the "Final 2021 LCRR EA") (USEPA, 2020a). Exhibit 5-5 provides summary statistics by LSL and CCT status from the existing data, ignoring differences in city water system, site, sampling event, and study sampling volume methodology.

[162] As the log of zero is not a real number, setting all known non-detects to a small, non-zero value allows log-transformation of all results in a dataset. It was not possible to determine detection limits or all non-detects for all included datasets, and known non-detects were identified from zeroes or missing values.

Exhibit 5-4: Summary Statistics for Tap Water Lead Concentrations by LSL and CCT Status Combinations, Country, and Citation

LSL	CCT	Country	Citation[a]	Geometric Mean Lead (µg/L)	Geometric SD Lead	Arithmetic Mean Profile Liter[b]	Arithmetic SD Profile Liter	Number of Samples	Number of Profiles	Number of Sites
LSL	None	USA	Schock, 2016	26.84	1.13	5.87	4.29	15	1	1
		CND	Craik, 2016	15.35	2.50	4.95	3.52	194	26	20
			Deshommes et al., 2016	26.87	2.14	3.99	2.80	309	69	27
			Desmarais et al., 2015	16.43	2.21	4.00	2.29	1,062	133	11
			EPCOR Water Services, 2008	21.45	1.93	3.87	3.26	107	26	11
			Hayes et al., 2014	14.55	1.71	6.00	3.47	120	5	5
			Muylwyk, 2016	16.63	2.56	1.00	0.50	248	124	123
LSL	Partial	USA	The Cadmus Group Inc., 2007	9.81	3.30	11.95	7.82	895	41	36
			Clarksburg, 2021	6.72	2.99	7.84	5.34	532	28	19
			Commons, 2011	14.60	2.70	7.81	4.78	121	8	8
			Del Toral, 2016	2.71	4.41	5.60	4.23	2,068	137	91
			O'Brien & Gere, 2015	14.77	2.99	1.77	2.14	133	46	7
			DC Water, 2016	6.17	3.16	8.48	5.55	205	13	6
			Schock, 2016	6.89	2.49	5.93	4.28	810	53	14
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	10.47	1.96	0.38	0.00	91	91	21
		CND	Camara et al., 2013	16.30	1.93	2.00	1.20	8	2	2
LSL	Representative	USA	Del Toral et al., 2013	8.00	2.03	6.19	3.70	695	57	32
			Del Toral, 2016	2.81	3.07	6.50	4.73	1,270	80	47
			DC Water, 2016	3.05	3.34	6.74	4.12	839	64	52
			Estes-Smargiassi et al., 2006	5.23	2.28	3.03	2.78	25	2	2
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	1.38	4.01	3.55	2.70	303	46	12
		CND	Campbell, 2016	1.89	3.57	2.15	1.35	4,997	1,205	639
Partial	None	USA	None	---	---	---	---	---	---	---
		CND	Craik, 2016	6.81	5.71	1.96	1.13	451	122	116
			Deshommes et al., 2016	12.71	2.04	4.76	3.26	248	40	40
			Desmarais et al., 2015	10.00	2.06	4.00	2.29	368	46	4
			Muylwyk, 2016	7.53	4.86	1.00	0.50	341	171	169
Partial	Partial	USA	The Cadmus Group, Inc., 2007	3.70	3.02	10.64	7.21	74	4	2
			Commons, 2011	9.12	2.88	3.56	2.19	48	7	7
			Commons, 2014	10.19	2.19	6.88	4.20	40	3	3
			O'Brien & Gere, 2015	8.84	2.57	1.70	2.11	25	9	1
			DC Water, 2016	8.80	1.93	7.50	4.47	15	1	1

LSL	CCT	Country	Citation[a]	Geometric Mean Lead (µg/L)	Geometric SD Lead	Arithmetic Mean Profile Liter[b]	Arithmetic SD Profile Liter	Number of Samples	Number of Profiles	Number of Sites
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	2.78	2.53	0.38	0.00	11	11	11
		CND	Camara et al., 2013	18.44	1.27	2.00	1.29	4	1	1
Partial	Representative	USA	DC Water, 2016	1.95	2.45	7.30	4.60	266	19	19
			Estes-Smargiassi et al., 2006	0.24	4.53	3.03	2.78	25	2	2
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	1.54	2.07	3.35	2.68	116	10	2
		CND	Campbell, 2016	1.71	3.37	4.00	2.30	152	19	11
No LSL	None	USA	None	---	---	---	---	---	---	---
		CND	Craik, 2016	0.82	9.18	1.97	1.13	322	85	85
			Deshommes et al., 2016	3.31	3.72	5.31	4.04	73	12	10
			Hayes et al., 2014	1.01	1.80	6.00	3.53	24	1	1
			Muylwyk, 2016	1.24	3.15	1.00	0.50	450	225	224
No LSL	Partial	USA	Del Toral, 2016	1.74	3.71	8.33	6.85	222	11	7
			DC Water, 2016	1.92	2.02	7.50	4.47	15	1	1
			Swertfeger et al., 2006; Desmarais et al., 2015; Triantafyllidou et al., 2015	2.41	3.59	0.38	0.00	61	61	5
		CND	Camara et al., 2013	1.42	2.98	2.00	1.29	4	1	1
No LSL	Representative	USA	Del Toral, 2016	0.66	1.81	6.87	4.87	118	7	4
			DC Water, 2016	0.66	2.39	6.44	3.83	51	4	4
		CND	None	---	---	---	---	---	---	---

Acronyms: CND = Canada; USA = United States of America; SD = standard deviation.

[a] Each citation contains data from a single city water system (Exhibit 5-1). Some citations have entries in multiple categories.

[b] Arithmetic mean and standard deviation (SD) of the "profile liter" term and number of individual sample bottles, profiles, and sites provide information regarding some of the differences in sampling methods observed among studies. Studies with fewer samples, or with smaller sample volumes, have smaller values of profile liter. Some studies always collected the same sample volume and others sampled to a particular point (e.g., until the water had run cold from the tap).

Exhibit 5-5: Summary Statistics, Including Geometric Mean, Standard Deviation (SD), Maximum Value, and Sample Size for Tap Water Lead Concentration Sample Data by LSL and CCT Status Used in Statistical Modeling

LSL Status	CCT Status	Number of Individual Samples	Geometric Mean Lead Concentration (µg/L)	Geometric SD Lead Concentration	Maximum Lead Concentration (µg/L)
LSL	None	2,055	17.79	2.27	170
Partial LSL	None	1,408	8.61	3.9	180
No LSL	None	869	1.15	5.32	119.3
LSL	Partial	4,863	5.15	4.02	2,970
Partial LSL	Partial	217	6.49	2.97	81.13
No LSL	Partial	302	1.86	3.6	36
LSL	Representative	8,129	2.37	3.60	714
Partial LSL	Representative	559	1.63	2.95	38.03
No LSL	Representative	169	0.66	1.98	12.3

Note: The table shows values based on the full dataset used for the analysis shown in Section 5.2.2, not just those at a particular position in a sampling series. These values were not directly used in blood lead modeling, as they do not adequately control for repeated sampling within sites and city water systems, or for differences in profile liter.

5.2.1.3 Coding

After cleaning the data as described above, the EPA added a centered "profile liter" term and contrast-coded variables describing LSL and CCT for use in fitting models. The profile liter term controls for differences in cumulative sample volume and sampling profile series position, as described in Section 5.2.1.1. Centering the intercept at the mean value of a profile liter for all samples allowed for improved interpretation of interaction terms. Contrast codes likewise improve interpretability and ease of projection from the fitted model, particularly when interactions are included.

To produce the centered profile liter term, the EPA calculated the midpoint of the cumulative sample volume, as described in Section 5.2.1.1. Then, the mean of the original profile liter term was subtracted from the profile liter term for all samples. This sets the intercept for the model to a profile liter of approximately 4.5,[163] this point is analogous to the fifth liter drawn from the tap after stagnation.

The EPA used the sample data's descriptive information on LSL status to generate two contrast variables that allow for the statistical comparison of water lead concentrations between the three LSL scenarios represented in the data ("LSL," "Partial," and "No LSL"). The "LSL (yes/no)" variable indicates lead concentration samples that come from sites with a full LSL compared to samples from locations with no LSL. "LSL (no/partial)" designates samples that come from sites with a partial LSL in place compared to site samples that come from locations with no LSL. Used together in the statistical model, these two variables allow the EPA to compare water lead concentrations in homes with no LSLs to concentrations in homes with full LSLs and homes with partial LSLs. Exhibit 5-6 shows the numeric codes used to describe LSL status in the analysis.

[163] The mean of the original, un-centered profile liter term is 4.495. This has been rounded to 4.5, or the "fifth liter" for readability throughout this document.

The EPA determined corrosion control levels for each lead concentration sample reported through records of CCT practices and implementation dates, as well as water quality samples. CCT was coded as a single contrast variable, “CCT (yes/no),” marking those tap samples taken in the presence of corrosion control against those sample taken at sites without CCT. This variable is used to quantify the difference between water lead concentrations at sites with representative CCT, partial CCT, and no CCT. Exhibit 5-7 shows the codes used to represent CCT in the analysis.

Exhibit 5-6: Numeric Values Assigned to Two Discrete Contrast Variables Representing LSL Status in the Estimated Drinking Water Lead Concentration Regression Model

LSL Status	LSL (yes/no)	LSL (no/partial)
LSL	-0.5	0
Partial	0	-0.5
No LSL	0.5	0.5

Exhibit 5-7: Numeric Values Assigned to a Discrete Contrast Variable Representing CCT Status Use in the Estimated Drinking Water Lead Concentration Regression Model

CCT Status	CCT (yes/no)
None	-0.5
Partial	0
Representative	0.5

5.2.2 Drinking Water Lead Concentration Model Fitting and Selection

Next, the EPA developed a model to estimate typical lead concentrations for each LSL/CCT status category, or “intervention category”. The intervention category is confounded with differences in profile liter of individual samples, as well as with numbers of sites and profiles from each city water system (Exhibit 5-4, Exhibit 5-5). Therefore, geometric means cannot be directly compared across intervention categories. Rather than selecting only samples from some common profile liter (e.g., the “first liter”), and aggregating within sites and city water systems to produce a homogeneous subset of the dataset, the EPA fit linear mixed-effects models with explicit terms to statistically control for the differences in profile liter, city water system, site, and sampling event. This single-step meta-analysis allowed for the greatest inclusion of available data, while limiting the effects of different methods.

The EPA fit multiple, nested, linear mixed-effects models (Equations 1-5, Exhibit 5-8) of tap water lead concentration as predicted by LSL presence (“LSL” or “No LSL”), LSL extent (“None” or “Partial”), CCT status, and profile liter. To simplify model fitting, these models assumed equal variance in lead concentration among combinations of LSL and CCT status, profile liter, and sampling events. This assumption means the model may slightly over- or under-estimate the variation in lead water concentrations in some scenarios. For instance, increased variability may occur as lead flushes from residential pipes after LSLR; or in cases of “partial” CCT, where poorly optimized and changing corrosion control may interact unpredictably with pipe chemistry to produce more variable concentrations than would be expected with fully optimized corrosion control.

The EPA compared several models, from simple to more complex, to find the best function for use in predicting lead concentrations at the tap (Equations 1- 5). For all models, the EPA allowed the intercept of the fitted equation (mean lead concentration at the fifth liter[164] assuming no LSL or CCT; see Section 5.2.1.2) to vary by sampling event and location, with each sampling event nested within a site and each site nested within a city water system[165]. The EPA also considered models that accounted for random variation in parameters, such as differences in length of a service line among sites, or specific features that could change the effectiveness of CCT, related to event, site, and city water system, but found that the collected dataset does not contain sufficient information to fit such models.

To describe the non-linear effects of the profile liter, the models include a natural cubic spline. The spline models the effect of the profile liter as a curve, and allows the fitted lead concentration to increase and decrease as water is drawn through the household and service line (Exhibit 5-2 and Exhibit 5-3). This spline included three interior knots and two boundary knots. Knots define points where different pieces of the curve meet and allow the model to be fit with different "sub" curves for each piece between the knots. The three interior knots correspond to the first 0.5, 4, and 8 liters after beginning sampling and have curves at either end. Boundary knots correspond to 0.06 liters and 13 liters after beginning sampling.[166] These knots produce linear sections at either end of the curve where there were few samples. Models were fitted with the *lme4* package in R (Bates, 2010; Bates et al., 2015; Pinheiro et al., 2017; R Core Team, 2016) with full-information maximum likelihood (FIML) for model comparisons and restricted maximum likelihood (REML) to produce final parameters after model selection (Bolker et al., 2009).[167]

In the equations below, "*i*" identifies a particular water sample, and "*j*" identifies a sampling event, nested within a site and a city water system. β refers to the coefficient for each parameter. Thus, β_{0j} is the intercept for a particular sampling event *j*. β_s terms refer to matrices of spline coefficients (not shown) for each model term that includes a spline. Thus, β_{s1} is the matrix of spline coefficients for the effect of the profile liter term alone.

The EPA selected the "Reduced spline model with CCT interactions" (Equation 2) to produce simulated lead concentrations for use in the benefits analysis. Although the most complex "full spline" model showed the best fit overall (Equation 1, Exhibit 5-8), the improvement in fit was small relative to the increase in complexity, and a close examination of the fitted model suggested that the full spline model over-fit specific study parameters and produced predictions that were likely unrealistic. The full model projected a gradual rise in lead concentration after the service line peak for some intervention

[164] The EPA centered the term for profile liter at its mean. As a result, the "fifth liter" occurs at the intercept, which is close to the fifth liter of a 5- liter sampling series, or roughly 30 seconds of flushing the tap.
[165] A 'nested' variable structure represents data where a particular factor level can occur only within a particular level of another factor. This structure reflects the structure of sample concentration data. A single sampling event could only occur within a particular site, and that site can only occur within a particular city.
[166] Interior knot positions were chosen to represent potentially important transition points in the profile. The fitted splines were compared against models that used standard quantile selection for interior knot position and were found to produce similar estimates. Therefore, the knot positions chosen by transition point (i.e., faucet, beginning, and end of largest service line-related lead increases) were retained for the final model.
[167] Using REML reduces bias in the SD of random effects parameters but does not produce meaningful values of log-likelihood, Akaike Information Criterion (AIC), or Bayesian Information Criterion (BIC) when comparing models with different fixed effects. Therefore, the EPA used FIML for model comparisons and REML to fit the final model.

combinations, which is unlikely to be realistic given that the water represented in this tail of the profile represents non-stagnated water from the system main. In addition, for homes with no LSLs, the full model produced predictions of relatively high lead concentrations in homes with representative CCT, and relatively low concentrations in homes with no CCT. Again, this is unlikely to represent the true effects of CCT; therefore, the simpler model was selected for simulation.

Full spline model:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + Spline(Profile\ Liter_i) * \beta_{s1} + \beta_1 LSL\ (yes/no)_{i_i} \\ & + \beta_2 LSL\ (no/partial)_i + \beta_3 CCT_i\ + \beta_4 LSL\ (yes/no)_{i_i} * CCT_i \\ & + \beta_5 LSL\ (no/partial)_i *\ CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s2} LSL\ (yes/no)_{i_i} \\ & + Spline(Profile\ Liter_i) *\ \beta_{s5}\ LSL\ (no/partial)_i \\ & + Spline(Profile\ Liter_i) *\ \beta_{s4}\ CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s5} LSL\ (yes/no)_{i_i} *\ CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s6} LSL\ (no/partial)_i *\ CCT_i +\ \varepsilon_i \end{aligned} \qquad \text{(Equation 1)}$$

Reduced spline model with CCT interactions:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + Spline(Profile\ Liter_i) * \beta_{s1}\ + \beta_1 LSL\ (yes/no)_i \\ & + \beta_2 LSL\ (no/partial)_i + \beta_3 CCT(level)_i \\ & + \beta_4 LSL\ (yes/no)\ _i * CCT_i + \beta_5 LSL\ (no/partial)_i *\ CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s2} LSL\ (yes/no)_i \\ & + Spline(Profile\ Liter_i) *\ \beta_{s5}\ LSL\ (no/partial)_i +\ \varepsilon_i \end{aligned} \qquad \text{(Equation 2)}$$

Reduced spline model without CCT interactions:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + Spline(Profile\ Liter_i) * \beta_{s1} \\ & + \beta_1 LSL(yes/no)_i + \beta_2 LSL\ (no/partial)_i + \beta_3 CCT_i \\ & + Spline(Profile\ Liter_i) * \beta_{s2} LSL\ (yes/no)_i \\ & + Spline(Profile\ Liter_i) *\ \beta_{s5}\ LSL\ (no/partial)_i \\ & +\ \varepsilon_i \end{aligned} \qquad \text{(Equation 3)}$$

Spline model with no interactions:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + Spline(Profile\ Liter_i) * \beta_{s1} \\ & + \beta_1 LSL(yes/no)_i + \beta_2 LSL\ (no/partial)_i + \beta_3 CCT_i \\ & +\ \varepsilon_i \end{aligned} \qquad \text{(Equation 4)}$$

Linear model with no interactions:

$$\begin{aligned} log_e\left(Pb\ \frac{\mu g}{L}\right)_{ij} = {} & \beta_{0j} + \beta_1(Profile\ Liter_i) \\ & + \beta_2 LSL\ (yes/no)_i + \beta_3 LSL\ (no/partial)_i + \beta_4 CCT_i \\ & +\ \varepsilon_i \end{aligned} \qquad \text{(Equation 5)}$$

Exhibit 5-8: Comparison of Tap Sample Lead Concentration Model Results Based on Maximum Likelihood Estimators for Goodness of Fit

Model	DF[a]	Log-Likelihood	AIC	BIC
Full spline (Equation 1)	34	-20,425	40,918	41,184
Reduced spline with CCT interaction (Equation 2)	22	-20,515	41,075	41,247
Reduced spline without CCT interaction (Equation 3)	20	-20,535	41,110	41,267
Spline model with no interactions (Equation 4)	12	-20,641	41,306	41,400
Linear with no interactions (Equation 5)	9	-21,220	42,458	42,529

[a] Degrees of freedom (DF) are the number of parameters estimated for the model, including the variance for each random effects level (sampling event is nested within the site nested within the city water system), fixed coefficients, and the residual error. The other columns provide model fit statistics for comparing the fixed terms of the model. AIC is Akaike's Information Criterion & BIC is Bayesian Information Criterion. For AIC and BIC, the smaller numbers imply more preferred models; and for log-likelihood, the larger numbers imply a better fit to the underlying data.

The reduced spline model with CCT interactions suggests that besides water system, residence (sampling location), and sampling event, the largest effects on lead concentration come from LSLs and the number of liters drawn since the last stagnation period (Exhibit 5-9).

Exhibit 5-9: Results from the Reduced Cubic Spline Interaction Model with CCT Interactions: Fixed Effects and Random Effects for Sampling Event, Site, and City Water System

Fixed Effects	β[a]	SE[b]	F (Type III SS)[c]
Intercept	1.47	0.156	96
Cumulative volume (spline)	--	--	169
LSL (yes/no)	-1.03	0.104	98
LSL (no/partial)	-0.82	0.191	19
CCT (no/representative)	-0.74	0.163	21
LSL (yes/no)* CCT (no/representative)	0.95	0.181	28
LSL (no/partial)* CCT (no/representative)	1.79	0.32	31
LSL (yes/no)* Cumulative volume (spline)	--	--	--
LSL (no/partial)* Cumulative volume (spline)	--	--	--
Random Effects[d]	**N**	**SD**	
Sampling event in site in city water system	3,130	0.51	
Site in city water system	1,657	1.06	
City water system	15	0.59	
Individual samples (Total N)[e]	18,571	---	

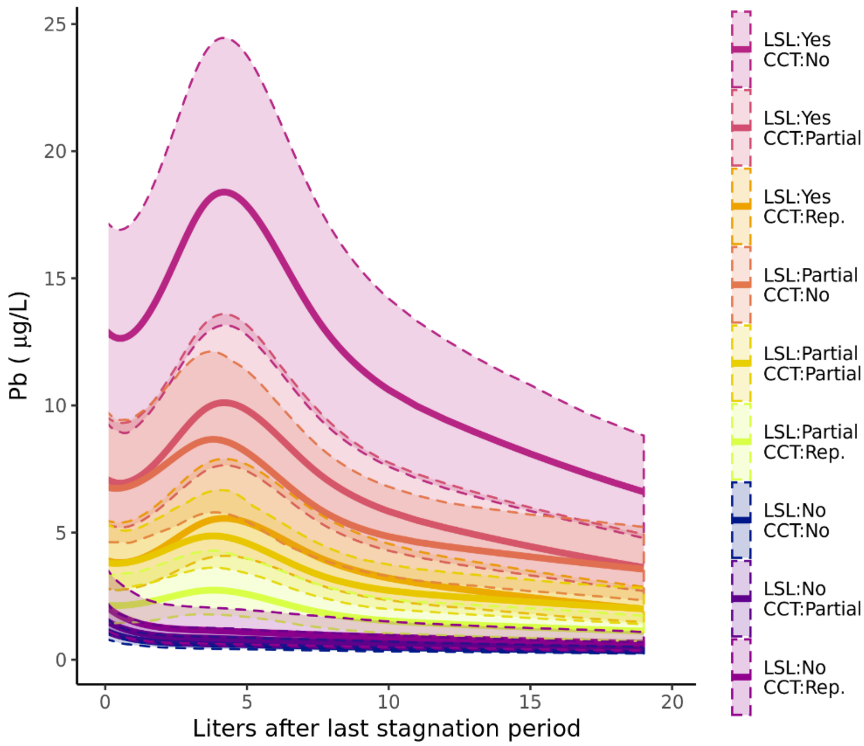
Acronyms: N = number of observations, and SD = standard deviation.
[a] β, the unstandardized regression coefficient, provides the size and direction of the relationship between each model term and log-transformed lead concentration. β for spline effects are too complex to show in this exhibit.
[b] SE shows the standard error estimated for each coefficient.
[c] F provides the F statistic for each coefficient after controlling for all other coefficients for type III sums of squares (SS). Unbalanced sample sizes for random effects complicate accurate degrees of freedom (DF) calculations, and no p-values are provided. However, larger F values indicate stronger effects.
[d] For random effects, N shows the number of groups at each level, and SD provides the attributable to that level of random effect.
[e] Total N is the number of individual sample bottles.

The fitted model for the reduced cubic spline interaction (Equation 2) was used to produce simulated concentrations of lead at the kitchen tap that statistically control for variation in the sample dataset due to differences in profile liter among studies, the city water system, the site, and the sampling event. Additionally, the simulated concentrations incorporate variation in lead levels found among sampling events, sites, and city water systems.

5.2.3 Simulated Drinking Water Lead Concentrations Based on Selected Model Fit

For use in blood lead modeling, the EPA produced 500,000 simulated lead concentrations based on the final model (reduced spline with CCT interactions; Equation 2; Exhibit 5-9). These concentrations were simulated for the first ten profile liter values taken after stagnation (Exhibit 5-10). This approximates simulations of ten one-liter samples drawn after stagnation. The simulated dataset includes derived concentrations for new cities, sites, and sampling events not found in the original dataset using estimates of variability and uncertainty from the fitted model, and given information on LSL and CCT status. While the simulated dataset includes variability similar to the original data, individual simulated estimates are best thought of as central tendencies of possible concentration values given fitted model parameters and estimated variance. The simulated results also incorporate the model assumptions of equal variance in lead concentration among different scenarios, and equal variance over the range of profile liters, as previously discussed in Section 5.2.2.

Exhibit 5-10: Estimates for the Simulated Data Showing the Relationship between Tap Lead Concentration and Profile Liter for Each Combination of CCT and LSL Status



Note: Central estimates are solid lines, and 95 percent confidence intervals (CIs) (bootstrapped) are indicated by shaded areas bounded by dotted lines. The highest concentrations occur, on average, roughly 5 liters after the last stagnation period in homes with LSLs in place. Note that CIs can overlap somewhat even where there is a significant effect of scenario (i.e., CCT and LSL presence). However, for scenarios with no LSLs, CIs for CCT scenarios overlap almost completely.

Though CCT produced significant reductions in lead water concentrations, the simulated predictions for sites with full LSL removals primarily overlapped for all CCT conditions in the final model Exhibit 5-9). Therefore, the EPA used the pooled estimate for all CCT conditions in residences with no LSL in place (this is referred to as "combined CCT"). Because of this overlap in the simulated data, the EPA was unable to quantify the impacts of improvements in CCT status on non-LSL households using these data.

Exhibit 5-11: LSL and CCT Scenarios and Simulated Geometric Mean Tap Water Lead Concentrations and Standard Deviations for the First Ten Liters Drawn after Stagnation for Each Combination of LSL and CCT Status

LSL Status	CCT Status	Simulated Mean of Log Lead (µg/L)	Simulated SD[a] of Log Lead	Simulated Geometric Mean of Lead (µg/L)	Simulated Geometric SD[a] of Lead
LSL	None	2.67	1.32	14.38	3.75

LSL Status	CCT Status	Simulated Mean of Log Lead (µg/L)	Simulated SD[a] of Log Lead	Simulated Geometric Mean of Lead (µg/L)	Simulated Geometric SD[a] of Lead
Partial LSL	None	1.92	1.33	6.85	3.77
No LSL	None	**-0.19**[b]	**1.33**[b]	**0.83**[b]	**3.78**[b]
LSL	Partial	2.07	1.33	7.93	3.77
Partial LSL	Partial	1.35	1.33	3.84	3.78
No LSL	Partial	**-0.19**[b]	**1.33**[b]	**0.83**[b]	**3.78**[b]
LSL	Representative	1.45	1.33	4.27	3.78
Partial LSL	Representative	0.76	1.33	2.14	3.78
No LSL	Representative	**-0.19**[b]	**1.33**[b]	**0.83**[b]	**3.78**[b]

Acronyms: LSL = lead service line; CCT = corrosion control treatment; SD = standard deviation.
[a] SD reflects "among-sampling event" variability.
[b] Bolded values show how simulated results were pooled to produce a common estimate for homes with no LSL across CCT conditions.

Although the existing data did not provide enough information to estimate the effect of CCT where no LSL were present (Exhibit 5-10 and Exhibit 5-11), the CCT status of the PWS is tracked in the analysis regardless of LSL status. This is described in Section 5.3. Note in Exhibit 5-11 that the statistics describing the distribution of tap water lead concentrations are the same for all three rows for "no LSLs," regardless of whether there is representative, partial, or no CCT. Effectively, in the primary analysis the EPA did not quantify the incremental benefits of CCT when LSLs are absent. On the other hand, because CCT is done on a system-wide basis, there are no incremental costs associated with providing CCT to homes without LSLs when it is being provided for the entire system. The impact of CCT for these no LSL homes likely varies by location depending on whether there are legacy system and/or household lead solder or higher lead content brass parts.

5.2.4 Determination of GRR, and Point-of-Use and Pitcher Filter Water Lead Concentrations

In addition to modeled drinking water concentrations described above, the following assumptions are made:

- The EPA assumes that mean water lead concentrations resulting from galvanized service lines previously downstream from an LSL are equivalent to the mean water concentration value for partial LSL replacements as reported in Exhibit 5-11. This assumption may under or overestimate the change in water lead concentration associated with GRR service line replacements.
- A point-of-use (POU) device is a water treatment device physically installed or connected to a single fixture, outlet, or tap to reduce or remove contaminants in drinking water. For the purposes of subpart I of 40 CFR 141, it must be certified by an American National Standards Institute (ANSI) accredited certifier to reduce lead in drinking water.
- A pitcher filter means a non-plumbed water filtration device, which consists of a gravity feed water filtration cartridge and a filtered drinking water reservoir, that is certified by an ANSI accredited certifier to reduce lead in drinking water.

To estimate benefits, both "POU" devices and filters are considered. Pitcher filters are useful in some cases, such as mitigating potential short-term increases in lead exposure. Due to the efficiency of these filters, the EPA chose to assign the lowest-modeled water concentration (0.83 µg/L) to those households using both pitcher filters and POU devices for the duration of their use, regardless of LSL and CCT status. In doing so, the EPA assumes that POU devices and pitcher filters are properly used and maintained for all drinking and cooking, and that the presence of treatment equipment provides the same reduction in lead exposure as the removal of a lead service line. These assumptions may overestimate this reduction in lead concentrations from the use of POU devices and pitcher filters.

5.2.5 Limitations of Baseline and Post-Rule Water Concentration Estimates

Although the EPA tried to account for and model variability in lead concentrations at the tap using all available historical datasets that met inclusion criteria, the underlying data and chosen modeling strategy have limitations. First, the datasets came from 16 water systems in the United States and Canada (Exhibit 5-1, Exhibit 5-4, and Exhibit 5-5). Within the United States, datasets include only samples from the EPA regions 1, 3, and 5. Therefore, the source data do not fully represent water quality conditions, chemistry differences in pipe scale, possible seasonal differences in leaching, and treatment practices across all the EPA regions. There was not enough information to include housing age, which may be related to additional sources of lead. Additionally, the original studies (Exhibit 5-1, Exhibit 5-4, and Exhibit 5-5) were conducted for different reasons by different entities, and sometimes varied in their sampling methods. Both of these issues may limit generalizability of the data. See Exhibit 5-7.

The simulated concentrations statistically control for differences in methodology among studies by standardizing the "profile liter" term and including random effects to control for repeated samples within sampling event, site, and city water system. This approach is not equivalent to conducting a large new study to collect consistent samples over a broader variety of water systems. As previously discussed, using simulated concentrations also incorporates some assumptions, such as equal variance in lead concentrations among different combinations of CCT and LSL status.

The resulting drinking water concentrations were minimally changed after incorporating the new data which became available the 2021 LCRR analysis was conducted. For a further description of the uncertainties and variabilities in the data, see Stanek et al. (2020).

5.3 Assignment of Drinking Water Lead Tap Concentrations to PWS Populations

This section first describes how the simulated drinking water concentrations described in Section 5.2 are assigned to each type of PWS, and next describes how the number of people in each PWS are estimated and tracked through the analysis period. Each tap water lead concentration displayed in Exhibit 5-11 is assigned to the various LSL, POU, pitcher filter, and CCT scenarios under the final rule. Due to data limitations, some scenarios have been assigned the same lead tap water concentration. As illustrated in Exhibit 5-10, in the case where there is no LSL, confidence limits on modeled drinking water concentrations, regardless of CCT status, all overlap. Therefore, as described in Section 5.2.1, these were combined in the analysis. It is possible that given more data, one might expect to see lower drinking water lead levels when CCT is optimized, however the available data did not allow the EPA to update

this assumption. For this reason, the EPA kept these scenarios separate in the benefits modeling, including tracking the number of people in PWSs with this LSL/CCT status.[168]

Mapping Exhibit 5-11 drinking water concentrations to modeled benefit scenarios is illustrated in Exhibit 5-12.

Exhibit 5-12: Mapping Simulated Drinking Water Lead Tap Concentrations to Benefit Scenarios

LSL Status	CCT Status	Geometric Mean Tap Water Lead Concentration[a] (µg/L)	Geometric SD
LSL	None	14.38	3.75
Partial LSL/GRR	None	6.85	3.77
No LSL	None	**0.83**[b]	**3.78**[b]
LSL	Partial	7.93	3.77
Partial LSL/GRR	Partial	3.84	3.78
No LSL	Partial	**0.83**[b]	**3.78**[b]
LSL	Representative	4.27	3.78
Partial LSL/GRR	Representative	2.14	3.78
No LSL	Representative	**0.83**[b]	**3.78**[b]
POU and pitcher filters[c]		**0.83**[b]	**3.78**[b]

[a] Simulated geometric mean water concentrations are based on available data for various LSL and CCT scenarios, as described in Section 5.2.3.
[b] Bolded values show how simulated results were pooled to produce a common estimate for homes with no LSLs across CCT conditions. Also, these "No LSL" values were used for POU lead tap concentrations.
[c] This value is used for all POU and pitcher filters, for the duration of use.

The EPA estimated benefits under both low and high cost scenarios used in the final LCRI that characterize some of the uncertainty in the cost estimates. The low and high cost scenarios differ in their assumptions about the number of PWSs above the action level (AL) which impacts the number of systems installing or re-optimizing CCT, the number of small systems selecting POU as a compliance alternative, and the number of water systems that supply temporary filters (POU or pitcher filters) due to multiple AL exceedances (ALEs). This difference in estimated ALE between the low and high scenario affects the timing and proportions of PWS populations that move from pre-regulatory, or baseline, water lead concentration values to new post-regulatory lead tap water concentration categories. Both pre- and post-regulatory water lead concentrations are shown in Exhibit 5-12.[169]

The monetary benefits of the rule are modeled in the SafeWater Lead and Copper Rule (LCR) model. For each model PWS, a population cohort is created in the SafeWater LCR model. Each simulated population cohort for each PWS has an age distribution equal to that of the general population and is followed in

[168] Note that these are also tracked in the cost side of the model (see Chapter 4).
[169] Note additional differences between lower and higher scenarios assumptions with regard to concentration response functions for the IQ, ADHD, and adult CVD premature mortality health endpoints also define the range between the estimated low and high scenario benefits but do not affect population movement between categories in the SafeWater LCR model. See Section 5.5 for additional detail.

the benefits analysis for 35 years. A new cohort of infants is added in each subsequent year of the 35-year analysis based on birth rates from the 2020 United States Census. Thus, 35 cohorts of people are modeled and can possibly accrue benefits due to implementation of the rule – one cohort for each year of the analysis.

In the analysis, the EPA assumes that characteristics of households with LSLs have the same characteristics as the general population in regards to the age and number of people living in the home.[170] Each statistical person within a model PWS in the SafeWater LCR model is initially assigned to one of the simulated drinking water lead concentrations in Exhibit 5-11, depending on the CCT status and number of LSLs assigned to that modeled system in the baseline. Depending on the rule requirements, implementation schedule, and each year's tracked system level 90th percentile tap sample lead concentration, a modeled PWS may experience changes in CCT, pitcher filter and POU status if the system has an ALE. The modeled PWS will also experience a decrease in the number of LSL/GRRs apart from an ALE given the proactive replacement requirements in the final LCRI. Based on these modeled changes in CCT, pitcher filter, POU, and LSL/GRR status, specific proportions of the modeled population within the system will be assigned to a new lead tap water concentration category representing the new technology in place at the system in each year of the 35-year period of performance.

For a further discussion of how this is implemented in the SafeWater LCR model, see Section 4.3.5 and the flow charts in Appendix B; and for the following discussions, see Section B.3, *Estimating the Cost of Compliance with the LCRI*:

- Small community water systems (CWSs) serving 3,300 or fewer people and all non-transient non-community water systems (NTNCWSs) can choose between POU and CCT and are assumed to choose whichever compliance option has the lowest cost.
- How the SafeWater LCR model determines if a PWS installs/optimizes CCT or installs a POU device.

Due to different assumptions, different numbers of people will experience benefits under the low- and high-cost scenarios. The Safe Water LCR model tracks the number of people who move from one treatment combination (*i.e.*, beginning condition) to another (*i.e.*, ending condition) over the 35-year analysis period across all model PWS strata under the low- and high-cost scenarios, respectively. Each population is assigned a concentration from Exhibit 5-12. In the case of a CCT installation or re-optimization, the entire population of a model PWS will move to the new CCT status at the same time. The EPA also assumes that the entire PWS moves to the drinking water lead concentration (from Exhibit 5-12), assigned to a POU device when this option is implemented by the PWS, which implies that everyone is properly using the POU device. Thus, a corresponding change in the concentration of lead in

[170] Note the EPA has insufficient data at the national level to model the potential correlations between at risk populations and housing characteristics that might put individuals at higher risk of lead exposure like presence of LSL, lead paint, and housing age. The case studies were conducted in the Environmental Justice analysis for the LCRI found that older housing stock. Housing is associated with higher lead-dust and higher blood lead levels in children, and potentially also with location of LSLs.

drinking water will occur for the entire PWS population in the year the change is implemented. Chapter 4 provides more detail on these assumptions.[171]

The portion of the population corresponding to the number of households undergoing service line replacement each year will change to the lower drinking water lead concentrations and BLLs in the year the LSL/GRR service line is replaced. To simplify the analysis, the EPA assumes no change in other sources of lead exposure besides drinking water over the 35-year timeline used in the analysis. This includes exposure to lead in drinking water not consumed in the home.

The EPA did not quantify the benefits of reduced lead exposure to individuals who reside and work in buildings that do not have LSL/GRR service lines. These buildings, while not having an LSL/GRR service line in place, may still contain leaded plumbing materials, including leaded brass fixtures and leaded solder. The EPA expects that the final LCRI requirements will result in reduced lead exposure to the occupants of these buildings as a result of improved monitoring and additional actions to optimize CCT.

In the final LCRI analysis, the EPA assumes there is no difference in the geometric mean water lead concentration in households with no LSL, regardless of CCT status. In other words, for each of the three scenarios of no LSL (i.e., no LSL – no CCT, no LSL – partial CCT, and no LSL – representative CCT), the geometric mean water lead concentration is equivalent to 0.83 µg/L, which is likely to lead to an underestimate of benefits. The EPA made this same assumption of a constant geometric mean water lead concentration in households with no LSL, regardless of CCT status as part of the assessment of the 2021 LCRR, and as part of the 2021 LCRR analysis the EPA attempted to assess the potential benefits to children in these non-LSL homes where CCT was improved. This approach assumed that there is still a benefit to CCT in the absence of an LSL due to the potential for reduced leaching of lead from internal fixtures such as lead solder on brass water faucets that would result in lower water lead concentrations. The agency has determined that the data are too limited and the uncertainties too significant to include this assessment in the quantified and monetized benefit estimates of the LCRI regulation. This analysis was presented in Appendix G of the Final 2021 LCRR EA (USEPA, 2020a).

[171] Under the final LCRI, PWSs with multiple ALEs must make temporary POU or pitcher filters available to all customers with service lines with lead or potential lead content. The EPA has assumed that 100% of these customers would pick-up and use these filters. This equates to between 9.7 and 17.1 million people who will use temporary POU or pitcher filters until their service line is replaced or confirmed not to have lead content.

5.4 Methods for Estimating Blood Lead Levels

The EPA assessed benefits of the final LCRI in terms of avoided losses in IQ in children aged 0-7, which required estimating blood lead levels in this age group using the SHEDS-Pb model (formerly known as SHEDS-IEUBK) (Zartarian et al. 2017, 2023; Stanek et al. 2020). See Zartarian et al., (2023) for an updated evaluation of this model. For the LCRI analysis the EPA used the SAS version of the model which was tailored during the 2021 LCRR to handle several different drinking water inputs. Additionally, as described in Section 5.5, the EPA estimated avoided cases of ADHD in children that result from additional actions required under the final rule. The EPA also estimated the avoided lower birth weight in infants due to reductions in their mother's lead exposure, and avoided cases of CVD premature mortality in both adult men and women. For older children and adults, the EPA uses the All-Ages Blood Lead Model (AALM), version 3 to estimate BLLs (USEPA, 2024b).

Section 5.4.1 describes methods used to estimate BLLs in young children. Section 5.4.2 describes the estimation of BLLs in older children and adults.

5.4.1 Methods for Estimating Blood Lead Levels in Children Ages 0-7

This modeling approach follows that described in Stanek et al., (2020) with minor updates to drinking water inputs, and soil and dust inputs to remain consist with other agency lead rulemakings. (Henning et al. 2024; Zartarian et al. 2023). The model used for children is the SHEDS-Pb model, which couples two existing models (The Stochastic Human Exposure and Dose Simulation (SHEDS)-Multimedia model described briefly in Section 5.4.1.1 and the integrated exposure uptake biokinetic (IEUBK) model, described briefly in Section 5.4.1.2). The SHEDS-Pb model has been evaluated against an empirical model (Henning et al., 2024).

Estimating benefits of the final LCRI in children requires estimates of BLLs from ages 0 to 7. Specifically, to estimate the effects of lead exposures on IQ, estimates of BLLs in each year of life from ages 0 to 7 and lifetime BLLs to age 7 are needed.

The agency compiled available environmental lead concentration data across various media (i.e., soil, air, food, and water). The lead concentration estimates for soil, air, and food in this analysis are held constant in the blood lead modeling in order to represent background lead levels[172], with the only varying concentration being drinking water. In order to estimate the potential changes in BLLs that

[172] With regard to adjusting baseline exposure over the 35-year period of analysis, in response to potential future changes in the non-water exposure pathways, the EPA has found no way to extrapolate lead concentrations over the period of analysis for the alternative media that would not introduce significant uncertainty into the BLL estimation modeling likely outweigh any perceived improvement. National level projections of decreases in lead dust and soil, and food concentrations over a decades long period are not available and projection of current trends would introduce significant uncertainty. Using projected values from NHANES to adjust estimated BLLs post modeling would also introduce significant uncertainty, as the rate of decrease in BLLs observed in NHANES has slowed in recent years. Therefore, the EPA held constant the non-water sources of lead over the 35-year analysis period. The EPA also notes that because of the log-linear shape of the concentration response function for IQ, and that the concentration response functions show no evidence of a threshold below which effects cease, projected policy scenario reductions in water lead concentrations that occur at lower baseline water lead levels (WLLs) would result in larger changes in avoided IQ point, therefore the inclusion of lower baseline values would result in increased benefit estimates associated with the final LCRI.

result from the final LCRI requirements, the EPA used several modeled/estimated drinking water lead concentration values associated with drinking water system scenarios that represent possible combinations of CCT, POU, pitcher filters, and LSL/GRR service line status, as described in Section 5.3 above and Exhibit 5-12. Following the methodology outlined in Stanek et al., (2020) the EPA used these inputs to relate total lead absorbed into the body to a set of BLLs representing the different CCT, POU, pitcher filter, and LSL/GRR service line scenarios.

This section begins with an overview of the two models used to produce these estimates, followed by a description of the methods for coupling the models.

5.4.1.1 SHEDS-Multimedia Modeling

SHEDS-Multimedia is a probabilistic model that simulates aggregate (i.e., multimedia) and cumulative population exposures to chemicals over space and time based on realistic activity patterns, concentration distributions, and exposure factors. Full details of this model and the inputs have been previously described (Zartarian et al., 2006, 2012, 2023; Xue et al., 2010, 2012a, 2012b, 2014a, 2014b; Glen et al., 2012; USEPA, 2016, Stanek et al., 2020). A brief overview is provided in this section.

The SHEDS-Multimedia model has undergone numerous peer reviews and has been well-validated for use in assessing exposures to diverse chemicals (USEPA, 2016). SHEDS-Multimedia provides exposure estimates as a result of both dietary and residential exposures, and it can be used to estimate these exposures by sex and age. SHEDS-Multimedia has the capability to assess exposures via ingestion, inhalation, and dermal pathways. However, dermal exposures are not considered in the current analysis because lead exposures through this pathway are assumed to be negligible.

SHEDS-Multimedia has several strengths that make it a powerful tool to assess chemical exposures, such as the ability to consider correlated inputs (e.g., correlations between concentrations of contaminants in dust and soil); and the use of two-stage Monte Carlo sampling, which allows variability in population exposure and dose estimates, and uncertainty associated with different percentiles to be quantified.

5.4.1.2 IEUBK Model

The IEUBK model was developed as a simulation tool to predict BLLs in children from birth up to age 7 and thereby assist in the risk assessment of contaminated sites (USEPA, 1994). The model is intended to "enable rapid calculations and recalculations of an extremely complex set of equations that includes scores of exposure, uptake, and biokinetic parameters" (USEPA, 1994, p. 1-1). It provides an estimate of the BLL for a population of similarly exposed children associated with specified concentrations of lead in media (*e.g.,* water, soil) in the child's environment (USEPA, 2007). In addition, the IEUBK model estimates the probability that a population of similarly exposed children with a given exposure scenario will have a BLL greater than a specified level. Users can modify inputs and assumptions within the model (e.g., concentrations of lead in environmental media, intake rates for environmental media) to explore the effects on children's BLLs.

The IEUBK model uses four main components to mathematically and statistically link environmental lead exposure to children's BLLs: exposure, uptake, biokinetics, and variability (White et al., 1998). Exposures are quantified by combining information on the concentration of lead in environmental media, the amount of contact with the media (e.g., amount of drinking water ingested per day), and the duration of

the contact (e.g., number of days) (White et al., 1998). The environmental media included in the IEUBK model are drinking water, soil, household dust, air, and food; exposure to lead based paint is assessed via its contribution to household dust and soil concentrations (White et al., 1998). The uptake component models the transfer of lead to the bloodstream (i.e., the absorption) after intake into the child's body via inhalation or ingestion routes. In the present analysis, the EPA used information from the IEUBK model on uptake and biokinetics only, as further described below in the SHEDS-Pb coupling section.

5.4.1.3 Background Lead Exposure Inputs into SHEDS-Pb

Exhibit 5-13 to Exhibit 5-16 provide a summary of the main inputs for the SHEDS-Pb analyses, which were previously published in the supplemental material of Zartarian et al. (2017) and a few updates are noted in this section. The final LCRI analysis uses updated soil and dust concentrations. The soil and dust concentrations are still based on the United States Department of Housing and Urban Development (HUD, 2011) American Healthy Homes Survey I (AHHS) 2005–2006 data, and now also include the AHHS II data (2018-2019) (USHUD, 2021). These concentrations are summarized in Exhibit 5-15 as the geometric means and geometric standard deviations of the lognormally distributed data and are consistent with Henning et al. 2024. The estimates for daily water consumption are used in conjunction with the set of drinking water system scenario modeled lead concentrations in Exhibit 5-12. The other levels, such as daily lead from food, dust, and soil are used as background and do not change across drinking water system scenarios.

Exhibit 5-13: Summary of Daily Water Consumption Inputs for Drinking Water Consumption in SHEDS-Pb Coupling (Zartarian et al., 2017)

Daily Water Consumption (mL/day) NHANES[a] 2005–2012										
Age (years)	**Age (months)[b]**	**N**	**Mean**	**SD**	**50th Percentile**	**Geometric Mean**	**Geometric SD**	**75th Percentile**	**95th Percentile**	**99th Percentile**
06 months	0–6[c]	1,246	662	320	630	526	2.5	854	1,216	1,481
0	0–11[c]	2,618	581	349	532	410	3.0	806	1,172	1,489
1	12–23	1,792	247	247	219	151	3.3	306	690	1,148
2	24–35	1,948	300	312	251	176	3.4	360	909	1,424
3	36–47	1,272	316	313	257	193	3.1	398	917	1,640
4	48–59	1,358	320	333	261	197	3.2	404	874	1,434
5	60–71	1,196	364	366	303	213	3.5	447	1,037	1,802
6	72–83	1,306	377	353	332	228	3.5	480	1,067	1,601

Acronyms: N = number of observations, and SD = standard deviation.
Source: Zartarian et al. (2017).
Note: This exhibit summarizes drinking water consumption values that were used as inputs for the SHEDS-Pb analysis. These values were previously published in the supplemental material of Zartarian et al. (2017).
[a] The National Health and Nutrition Examination Survey (NHANES) is a program of studies designed to assess the health and nutritional status of adults and children in the United States. It provides nationally representative data on the United States population, including estimates of drinking water consumption.
[b] Age in months was added to clarify the age ranges listed in years.
[c] Water consumption for 0–11 months was used in the modeling for 6–11 month-old infants.

Exhibit 5-14: Summary of Daily Inputs for Dietary Lead Intake (µg/day) in SHEDS-Pb (Zartarian et al. (2017))

Age (years)	Age (months)[a]	N	Mean	SD	Median	Geometric Mean	Geometric SD	75th Percentile	95th Percentile	99th Percentile
06 months	0–6	1,072	0.7	0.98	0.3	0.27	4.75	0.91	2.71	3.47
1	12–23	2,226	2.58	1.84	2.17	2	2.16	3.41	5.83	7.63
2	24–35	1,788	3.44	2.03	3.06	2.85	1.94	4.49	7.23	8.46
3	36–47	1,160	3.54	2.06	3.18	2.98	1.89	4.63	7.26	8.43
4	48–59	1,240	3.57	2.16	3.18	3	1.87	4.55	7.25	8.63
5	60–71	1,066	3.85	2.18	3.43	3.31	1.77	4.83	7.86	9.52
6	72–83	1,086	3.8	2.02	3.51	3.29	1.76	4.84	7.55	8.3

Acronyms: N = number of observations, and SD = standard deviation.
Notes: This exhibit summarizes dietary lead intake values that were used as inputs for the SHEDS-Pb analysis. These values were previously published in the supplemental material of Zartarian et al. (2017).
Data sources: United States Food and Drug Administration's (FDA's) Total Diet Study (TDS) 2007–2013 and recipe mapping data from the Center for Food Safety and Applied Nutrition (CFSAN).
Method source: Xue et al., 2010. N=Number of Observations
[a] Age in months was added to clarify the age ranges listed in years. Data for 6–11 month-old infants not available.

Exhibit 5-15: Summary of Inputs for Soil and Dust Lead Concentration (µg/gram) in SHEDS-Pb Coupling (USHUD 2011, 2021)

Data Source	Housing Vintage	Dust Concentration (GM, GSD)	Soil Concentration (GM, GSD)
AHHSI + AHHSII	**Pre-1940**	**177.98, 2.23**	**267.6, 3.37**
	1940-1959	**114.20, 2.20**	**73.94, 2.88**
	1960-1977	**75.40, 2.00**	**29.06, 2.47**
	Post-1978	**52.87, 2.04**	**14.54, 2.46**

Acronyms: N = number of observations; SD = standard deviation
Source: United States Department of Housing and Urban Development (USHUD, 2011) American Healthy Homes Survey I (AHHS) 2005–2006 data, and the AHHS II data (2018-2019) (USHUD, 2021)**Notes:** This exhibit summarizes soil and dust lead concentration values for the lognormal distribution for each of the four vintages of housing for the combined survey data that were used as inputs for the SHEDS-Pb analysis. These values were updated from Zartarian et al. (2017). They now include the United States Department of Housing and Urban Development

(USHUD, 2011) American Healthy Homes Survey I (AHHS) 2005–2006 data, and the AHHS II data (2018-2019) (USHUD, 2021).

Exhibit 5-16: Summary of Daily Inputs for Soil/Dust Ingestion (mg/day) in SHEDS-Pb (Özkaynak et al., 2022)

Age	Soil/Dust	Mean	SD	50th Percentile	Geometric Mean	Geometric SD	95th Percentile
0-<1M	mg total	32	44	18.9	19	2.9	103
1-<3M	mg total	36	53	20.4	21	2.8	116
3-<6M	mg total	37	47	22.6	23	2.7	112
6-<12M	mg total	44	70	25.8	26	2.8	133
1 - <2Y	mg total	48	57	31.4	32	2.4	140
2 - <3Y	mg total	52	65	33.9	32	2.9	158
3 - <6Y	mg total	59	70	36.9	36	2.9	190
6 - <11Y	mg total	56	75	32.5	30	3.3	187

Acronyms: M = months; Y = years; SD = standard deviation
Source: Özkaynak et al. (2022).
Notes: This exhibit summarizes soil/dust ingestion values, which were used as inputs for the SHEDS-Pb analysis. These values were published in Özkaynak et al. (2022), Table 2.

5.4.1.4 Coupling of SHEDS-Multimedia and IEUBK Models for SHEDS-Pb Modeling

To estimate changes in children's BLLs as a result of the rule with the SHEDS-PB Model, the EPA first used the SHEDS-Multimedia probabilistic estimates of lead intakes from all routes of exposure for children aged 0 to 7 summarized above. In the coupling methodology, SHEDS-Multimedia takes the place of the exposure and variability components of the IEUBK model by generating a probability distribution of lead intakes (µg/day).

The distributions of inputs from SHEDS are then converted to lead uptakes in the model by multiplying by the route-specific (*e.g.,* inhalation, ingestion) absorption fractions, thereby accounting for the uptake component of IEUBK. The absorption fractions are summarized in Exhibit 5-17 and are the default values in IEUBK.

Exhibit 5-17: Default Lead Absorption Fractions across Media Used in SHEDS-Pb Model Runs

Media	Absorption Fraction (%)
Soil	30
Dust	30
Water	50
Diet	50
Air	32

Source: White et al. (1998).
Note: This exhibit summarizes absorption fractions across media, which are the default IEUBK values.

Applying these absorption fractions results in distributions of lead uptake by exposure/media route, which can be summed across routes to give total lead uptake per day (µg/day). Next, the EPA used age-based relationships derived from IEUBK to relate these lead uptakes (µg/day) to BLLs (µg/dL). The aim was to develop a “reduced form” of the IEUBK model, allowing BLL distributions to be efficiently estimated without having to apply the full version of the IEUBK model. Specifically, as described in Zartarian et al. (2017, 2023) and Stanek et al. (2020) the EPA developed regression equations between lead uptake and blood lead by running IEUBK with increasing amounts of lead intake. Since the relationship between lead uptake and blood lead in IEUBK is not perfectly linear, SHEDS-Pb uses a polynomial regression to address the slight departures from linearity, which represent the non-linear binding of lead to red blood cells. Exhibit 5-18 shows age-specific regressions used to describe an age-dependent relationship relating lead uptake to blood lead. The coefficients pertain to a third-order polynomial regression of the form:

$$\text{Blood lead } (\mu g/dL) = \beta_0 + \beta_1 \text{ Uptake} + \beta_2 \text{ Uptake}^2 + \beta_3 \text{ Uptake}^3 + e \qquad \text{(Equation 6)}$$

Coefficients for the month that represents the midpoint of the age range of interest were used in the analyses.

Exhibit 5-18: Age-Specific Polynomial Regressions Equations for Approximating IEUBK (Zartarian et al., 2017)

IEUBK Age Interval (year)	Age (months)[a]	β_0	β_1	β_2	β_3
0.5–1	6–11	7.86E-03	5.47E-01	-1.31E-03	6.01E-6
1–2	12–23	-3.11E-04	4.47E-01	-6.37E-04	1.53E-6
2–3	24–35	1.23E-03	3.79E-01	-4.29E-04	8.45E-7
3–4	36–47	6.58E-04	3.55E-01	-3.71E-04	6.24E-7
4–5	48–59	6.36E-04	3.36E-01	-3.38E-04	5.44E-7
5–6	60–71	1.65E-03	3.13E-01	-2.78E-04	3.57E-7
6–7	72–83	1.32E-04	2.88E-01	-2.30E-04	3.08E-7

Source: Zartarian et al. (2017).
Notes: $R^2 > 0.995$. This exhibit summarizes the coefficients used for age-specific IEUBK modeling to predict BLLs.
[a] Age in months was added for consistency across input tables.

To account for biological variability, the EPA applied a biological variance correction factor of 0.185 for 1- to < 2-year-olds and 0.176 for 2- to < 7-year-olds to the predicted blood lead variance estimated by the SHEDS-Pb model. Additional details about the calculation of these biological variance correction factors can be found in Zartarian et al. (2017).

Zartarian et al. (2017) compared estimates generated using SHEDS-Pb to BLL estimates reported from the National Health and Nutrition Examination Survey (NHANES) (2013–2014) and from the National Human Exposure Assessment Survey (NHEXAS) and were shown to closely estimate these BLLs. For further information on SHEDS-Pb model development and evaluation, refer to Zartarian et al.’s (2017) paper, “Children’s Lead Exposure: A Multimedia Modeling Analysis to Guide Public Health Decision-Making.” Additionally, Henning et al., (2024) further validated the SHEDS-Pb model using data from NHANES 2011-2016.

5.4.1.5 *Estimates of Pre- and Post-Rule Blood Lead Levels in Young Children*

Exhibit 5-19 presents modeled SHEDS-Pb geometric mean BLLs in children by year of life. The BLLs in this exhibit represent what children's BLLs would be if they lived under the corresponding drinking water system scenario for their entire lives from birth to age 7. These BLLs are used as inputs for the representative children in each corresponding PWS for the benefits modeling, and do not represent weighted population estimates. In the SafeWater LCR model analyses of benefits, the EPA estimated lifetime BLLs from these values by taking the average of the BLLs for each year of the child's life, up to age 7, based on their drinking water system scenario status during each year. The age at implementation of the rule was taken into account when calculating lifetime average BLLs. If, for example, the child is age 3 at implementation of the rule, the EPA would calculate lifetime average BLLs by averaging 3 years of pre-rule BLLs and 4 years of post-rule BLLs. Or, if the child is age 5 at implementation of the rule, the EPA would calculate lifetime average BLLs by averaging 5 years of pre-rule BLLs and 2 years of post-rule BLLs. The column labeled "Average" contains calculated average lifetime BLLs, assuming a child lived in the corresponding LSL/GRR service line, CCT, POU, or pitcher filter scenario for their entire life.

Exhibit 5-19: Modeled SHEDS-Pb Geometric Mean (GM) Blood Lead Levels in Children for Each Possible Drinking Water Lead Exposure Scenario for Each Year of Life

Lead Service Line Status	Corrosion Control Treatment Status	Water Concentration	GM Blood Lead Level (µg/dL)[b] for Specified Year of Life							
			0-1[a]	1-2	2-3	3-4	4-5	5-6	6-7	Avg.[c]
LSL	None	14.38	4.94	2.74	2.82	2.71	2.78	2.95	2.61	3.08
Partial LSL/GRR	None	6.85	3.12	1.98	2.01	2.01	2.01	2.08	1.84	2.15
No LSL	None	0.83	1.19	1.28	1.30	1.28	1.30	1.39	1.10	1.26
LSL	Partial	7.93	3.27	2.11	2.13	2.10	2.08	2.21	1.95	2.27
Partial LSL/GRR	Partial	3.84	2.18	1.64	1.66	1.68	1.64	1.72	1.47	1.71
No LSL	Partial	0.83	1.19	1.28	1.30	1.28	1.30	1.39	1.10	1.26
LSL	Representative	4.27	2.36	1.72	1.73	1.74	1.73	1.80	1.53	1.80
Partial LSL/GRR	Representative	2.14	1.65	1.47	1.45	1.47	1.46	1.51	1.28	1.47
No LSL	Representative	0.83	1.19	1.28	1.30	1.28	1.30	1.39	1.10	1.26
POU or pitcher filter		0.83	1.19	1.28	1.30	1.28	1.30	1.39	1.10	1.26

[a] Blood lead levels for the first year of life are based on regression from IEUBK for 0.5- to 1-year-olds only.

[b] These values represent the blood lead for a child living with the LSL/CCT status in the columns to the left. Each year blood lead corresponding to actual modeled child is summed and divided by 7 in the model to estimate lifetime average blood lead.
[c] This column contains calculated average lifetime blood lead levels assuming a child lived in the corresponding LSL/GRR service line, CCT, POU, or pitcher filter scenario for their entire life.

Changes in the geometric mean BLL averages in children ages 0-7 due to the anticipated changes in lead drinking water concentration associated with the final LCRI regulatory requirements are summarized in Exhibit 5-20.

Exhibit 5-20: Anticipated Decreases in Blood Lead Levels in Children

Pre-Rule Drinking Water				Post-Rule Drinking Water				Estimated Decrease in GM BLL (µg/L)
Water Lead Conc. (µg/L)	BLL (µg/L)	LSL Status	CCT Status	Water Lead Conc. (µg/L)	BLL (µg/L)	LSL Status	CCT Status	
14.38	3.08	LSL	None	0.83	1.26	No LSL	None	1.82
14.38	3.08	LSL	None	4.27	1.8	LSL	Representative	1.28
14.38	3.08	LSL	None	0.83	1.26	No LSL	Representative	1.82
14.38	3.08	LSL	None	0.83	1.26	POU or pitcher filter		1.82
6.85	2.15	Partial/GRR	None	0.83	1.26	No LSL	None	0.89
6.85	2.15	Partial/GRR	None	2.14	1.47	Partial	Representative	0.68
6.85	2.15	Partial/GRR	None	0.83	1.26	No LSL	Representative	0.89
6.85	2.15	Partial/GRR	None	0.83	1.26	POU or pitcher filter		0.89
0.83	1.26	No LSL	None	0.83	1.26	No LSL	Representative	0
0.83	1.26	No LSL	None	0.83	1.26	POU or pitcher filter		0
7.93	2.27	LSL	Partial	0.83	1.26	No LSL	Partial	1.01
7.93	2.27	LSL	Partial	4.27	1.8	LSL	Representative	0.47
7.93	2.27	LSL	Partial	0.83	1.26	No LSL	Representative	1.01
7.93	2.27	LSL	Partial	0.83	1.26	POU or pitcher filter		1.01
3.84	1.71	Partial/GRR	Partial	0.83	1.26	No LSL	Partial	0.45
3.84	1.71	Partial/GRR	Partial	2.14	1.47	Partial	Representative	0.24

Pre-Rule Drinking Water				Post-Rule Drinking Water				Estimated Decrease in GM BLL (µg/L)
Water Lead Conc. (µg/L)	BLL (µg/L)	LSL Status	CCT Status	Water Lead Conc. (µg/L)	BLL (µg/L)	LSL Status	CCT Status	
3.84	1.71	Partial/GRR	Partial	0.83	1.26	No LSL	Representative	0.45
3.84	1.71	Partial/GRR	Partial	0.83	1.26	POU or pitcher filter		0.45
0.83	1.26	No LSL	Partial	0.83	1.26	No LSL	Representative	0
0.83	1.26	No LSL	Partial	0.83	1.26	POU or pitcher filter		0
4.27	1.8	LSL	Representative	0.83	1.26	No LSL	Representative	0.54
4.27	1.8	LSL	Representative	0.83	1.26	POU or pitcher filter		0.54
2.14	1.47	Partial/GRR	Representative	0.83	1.26	No LSL	Representative	0.21
2.14	1.47	Partial/GRR	Representative	0.83	1.26	POU or pitcher filter		0.21
0.83	1.26	No LSL	Representative	0.83	1.26	POU or pitcher filter		0

5.4.2 Methods for Estimating Blood Lead Levels in Older Children and Adults

The EPA estimated the BLLs associated with exposure from drinking water in older children and adults. The EPA estimated BLLs in older children and adults for each year of life, beginning at age 8 and ending at age 79. The EPA assessed males and females.

5.4.2.1 Overview of the All Ages Lead Model

The EPA's All Ages Lead Model (AALM) tool relates exposure to lead from various exposure media over a lifetime to lead levels in blood and other tissue (USEPA, 2024c). The AALM includes developments from previous models, including the IEUBK model among other lead models. The tool consists of a lead exposure model and a lead biokinetics model. User inputs for selected environmental media (soil, dust, water, air, and food) are used in the exposure model to predict lead intake per day for a simulated individual accounting for sex and age differences. The AALM tool produces an estimate of lead concentration in various tissues and excreta, including estimate of blood lead levels over a lifetime. The calculation for lead intake is generally summarized in the following equations:

Lead intake from air, dust, soil, and water:

$$INmedium = \sum_{t=1}^{n}(Pbmedium_i \cdot fmedium_i) \cdot IRmedium \quad \text{Equation (7)}$$

- $INmedium$ $= Pb\ intake\ rate\ (\mu g\ PB/day)\ for\ a\ specific\ environmental\ medium$

- $Pbmedium_i = exposure\ concentration\ (e.g., \mu g\ PB/L\ water)\ in\ that\ medium\ for\ a\ given\ exposure\ setting\ i$
- $fmedium = fraction\ of\ total\ intake\ of\ the\ medium\ that\ occurs\ in\ setting\ i$
- $IRmedium = intake\ rate\ of\ medium\ (e.g., L\ water/day)$

Lead intake from food and other gastrointestinal sources:

$$INmedium = \sum_{t=1}^{n}(Pbintake_i) \qquad \text{Equation (8)}$$

- $Pbintake_i$ = *rate of Pb intake (µg PB/day) entered for the medium for exposure setting i*

Analysis in All Ages Lead Model (AALM)

The EPA released AALM version 2.0 for public use in September 2019. It was peer reviewed by the EPA's Science Advisory Board (SAB), and their report was released in August 2020. The agency began updating the AALM version 2.0 in 2021, which included updates to the user interface and to the code, including a revised lung model. The beta version of the updated model was used by the EPA to estimate the blood lead levels for the proposed LCRI. For the final LCRI modeling presented here, the EPA used AALM version 3.0, which is publicly available and reflects updates resulting from the peer review process. (USEPA, 2024b). The AALM model was evaluated for performance in predicting adult blood levels against available data from exposed workers and was shown to perform reasonably well, although with some variability (USEPA, 2019b).

For each combination of LSL and CCT status, the geometric mean water concentrations, as presented in Exhibit 5-12, were entered as the lead concentration in water that a modeled individual, male or females was exposed to throughout their lifetime from age 0 to 79 years. Exhibit 5-21 displays the constant variables entered into the AALM for water, soil, dust, and air. The AALM will apply the intake or concentration for all age years after the age where the value is entered, or until another value is specified at another age. To complete this modelling, the intake and concentrations between ages were interpolated. Lead intake from food was estimated in AALM using the recommended inputs in the EPA's Technical Support Document for the All Ages Lead Model (AALM) version 3.0 – Parameters, Equations, and Evaluations (2024), and intakes differed by sex. These inputs are based on lead contamination in food and beverages, excluding drinking water. The values do not include contamination of food introduced during food preparation (e.g. dust contaminated surfaces). The values in Exhibit 5-21 follow the AALM guidance for determining model inputs for lead in food.

Exhibit 5-21: Constant Variables Entered into the AALM for Both Sexes

Media parameter (units)	Age (years) value starts	Values Entered	Data Source
Water intake (L/day)	0	0.2	AALM default values (Technical Support Document, pp. 281-282) adapted from the 2011 Exposure Factors Handbook, Table 3-1
	0.25	0.3	
	1	0.35	
	10	0.45	
	15	0.55	
	25	0.7	
	50	1.04	
Soil concentration (µg/g)	0	61.3365	Weighted average based on data of lead-based paint homes from HUD's American Healthy Homes Survey (AHHS) I and II Lead Findings report (Exhibit 5-15)(USHUD, 2011, USHUD, 2021)
Soil intake (g/day)	0	0	Özkaynak et al. 2022, Table 2 (Geometric mean)
	0.083	0	
	0.25	0	
	0.5	0	
	1	0.0048	
	2 3 6 11 16	0.012 0.014 0.013 0.0076 0.0023	
Dust concentration (µg/g)	0	84.2943	Weighted average based on data of lead-based paint homes from HUD's American Healthy Homes Survey (AHHS) I and II Lead Findings report (Exhibit 5-15)(USHUD, 2011, USHUD, 2021)
Dust intake (g/day)	0	0.019	Özkaynak et al. 2022, Table 2 (Geometric mean)
	0.083	0.021	
	0.25	0.023	
	0.5	0.026	
	1	0.023	
	2 3 6 11 16	0.014 0.015 0.013 0.0088 0.0035	
Air concentration (µg/m^3)	0	0.01	The EPA's 2017 Proposed Modeling Approaches for a Health-Based Benchmark for Lead in Drinking Water and Cavender, 2013
Air ventilation rate (m^3/day)	0	2.9	AALM default values based on the 2011 Exposure Factors Handbook, ICRP (1994), and the EPA Technical Review Workgroup ventilation rates

Media parameter (units)	Age (years) value starts	Values Entered	Data Source
			(Stifelman 2007, Brochu et al. 2006, IOM 2005, Layton 1993)
	1	5.2	
	5	8.8	
	10	15.3	
	15	17.9	
	25	19.9	
Males Food Lead intake (µg/day)	0	2.2	The EPA’s (2024) Technical Support Document for the All Ages Lead Model (AALM) version 3.0 – Parameters, Equations, and Evaluations
	1	3	
	2	3.7	
	3	5.3	
	4	5.6	
	5	5.9	
	6	6.2	
	7	6.6	
	8	6.9	
	9	7.3	
	10	7.7	
	15	10.8	
	20	11.1	
	25	11	
	30	10.8	
	40	10.5	
	50	10.1	
	60	9.8	
	70	9.5	
	80	9.1	
	90	8.8	
Females Food Lead Intake (µg/day)	0	2.1	The EPA’s (2024) Technical Support Document for the All Ages Lead Model (AALM) version 3.0 – Parameters, Equations, and Evaluations
	1	2.9	
	2	3.8	
	3	5.4	
	4	5.7	
	5	6	
	6	6.4	
	7	6.7	

Media parameter (units)	Age (years) value starts	Values Entered	Data Source
	8	7	
	9	7.3	
	10	7.6	
	15	9.2	
	20	8.8	
	25	8.7	
	30	8.5	
	40	8.3	
	50	8	
	60	7.7	
	70 80	7.5 7.2	
	90	7	

Lead concentrations in soil and dust were consistent for all age groups and calculated as a weighted average based on prevalence data of lead-based paint in homes by construction year in select housing reported in U.S. Department of Housing and Urban Development's (HUD) American Healthy Homes Survey (AHHS) I and II Lead Findings (17). Construction year of homes is categorized into four bins: pre-1940, 1940-1959, 1960-1977, and 1978-2017, which is consistent with OCSPP methodology for reconsideration of the DLHS/DLCL. For each bin of housing construction year, the percentage of total housing was multiplied by the geometric dust concentration. Soil lead concentration was calculated with the geometric mean soil concentration using the same methodology. Soil and dust intake rates by age group up to age 21 were estimated by Özkaynak et al. (2022).

AALM model simulations for adults do not account for higher historical lead exposures and long-term bone accumulation that may have occurred prior to the baseline or regulatory scenarios. Also, with regard to adjusting baseline exposure over the 35-year period of analysis, in response to potential future changes in the non-water exposure pathways, the EPA has found no way to extrapolate lead concentrations over the period of analysis for the alternative media that would not introduce significant uncertainty into the BLL estimation modeling likely outweigh any perceived improvement. National level projections of decreases in lead dust and soil, and food concentrations over a decades long period are not available and projection of current trends would introduce significant uncertainty. Using projected values from NHANES to adjust estimated BLLs post modeling would also introduce significant uncertainty, as the rate of decrease in BLLs observed in NHANES has slowed in recent years. Therefore, the EPA held constant the non-water sources of lead over the 35-year analysis period. The EPA also notes that because of the log-linear shape of the concentration response function for CVD premature mortality, and given that the concentration response functions show no evidence of a threshold below which effects cease, projected policy scenario reductions in water lead concentrations that occur at lower baseline WLLs would result in larger changes in avoided CVD premature mortality, therefore the inclusion of lower baseline values would result in increased benefit estimates associated with exposed adult populations in the final LCRI.

5.4.2.2 Estimates of Pre- and Post-Rule Blood Lead Levels in Adults

Exhibit 5-22 displays BLL estimates for adults by each LSL/GRR service line, POU, pitcher filter or CCT status combination summarized by age groups. Note that when "No LSL" is the beginning or post-rule state, 0.83 µg/L is the assumed concentration across all levels of CCT status (i.e., none, partial, representative). The extent to which changes in CCT status make meaningful differences in lead concentrations for those without LSLs cannot be determined from the results presented in Exhibit 5-22.

Exhibit 5-22: Estimates of Blood Lead Levels in Adults Associated with Drinking Water Lead Exposures from LSL/CCT or POU Combinations

Lead Service Line Status	Corrosion Control Treatment Status	Sex	Geometric Mean Blood Lead Level (µg/dL) for Specified Age Group[1] in Years from the AALM							
			8-15	16-19	20-29	30-39	40-49	50-59	60-69	70-79
	None	Male	1.33	1.28	1.70	1.82	1.92	1.98	1.36	1.94
LSL		Female	1.25	1.44	1.99	2.14	2.27	2.35	1.56	2.31
Partial	None	Male	1.03	1.00	1.30	1.35	1.37	1.39	1.36	1.34
LSL/GRR		Female	0.97	1.10	1.47	1.53	1.56	1.59	1.56	1.53
No LSL	None	Male	0.80	0.77	0.98	0.97	0.94	0.92	0.88	0.85
		Female	0.74	0.83	1.06	1.03	1.00	0.98	0.94	0.91
LSL	Partial	Male	1.08	1.04	1.36	1.42	1.45	1.47	1.45	1.42
		Female	1.01	1.15	1.55	1.62	1.66	1.70	1.67	1.65
Partial LSL/GRR	Partial	Male	0.92	0.89	1.14	1.16	1.16	1.15	1.12	1.10
		Female	0.85	0.96	1.26	1.28	1.28	1.28	1.25	1.22
No LSL	Partial	Male	0.80	0.77	0.98	0.97	0.94	0.92	0.88	0.85
		Female	0.74	0.83	1.06	1.03	1.00	0.98	0.94	0.91
LSL	Representative	Male	0.93	0.90	1.16	1.19	1.19	1.19	1.16	1.13
		Female	0.87	0.98	1.29	1.32	1.32	1.32	1.29	1.27
Partial LSL/GRR	Representative	Male	0.85	0.82	1.05	1.05	1.03	1.02	0.99	0.96
		Female	0.79	0.89	1.15	1.14	1.12	1.11	1.07	1.04
No LSL	Representative	Male	0.80	0.77	0.98	0.97	0.94	0.92	0.88	0.85
		Female	0.74	0.83	1.06	1.03	1.00	0.98	0.94	0.91
POU or pitcher filter		Male	0.80	0.77	0.98	0.97	0.94	0.92	0.88	0.85
		Female	0.74	0.83	1.06	1.03	1.00	0.98	0.94	0.91

[1]The estimated values reported in this exhibit represent the mean BLL for the ages specified in the range. The AALM reports age-specific yearly BLLs for each single year age that are used in the SafeWater LCR benefits model.
Note: This exhibit displays BLL estimates for adults by each LSL, POU, pitcher filter or CCT combination summarized by age groups. The EPA assumes that GRR service line water lead concentrations are the same as "Partial LSL" values, therefore, BLL values for partial LSLs also represent GRR BLLs. Note that BLLs by each year (not age group average) are used in the analysis.

The estimated BLLs in are average adult BLLs given the corresponding estimated lead tap water concentrations resulting from LSL/GRR service line, CCT, POU, and pitcher filter status at steady-state, holding other exposures constant. In the SafeWater LCR model, water systems are tracked as they move from one LSL/GRR service line, CCT, pitcher filter or POU status to another as a result of rule implementation. The numbers of males and females in each age group served by those water systems are proportional to the age/sex makeup of the United States population as a whole. Age specific yearly BLLs are used in the benefit valuation modeling. shows the estimated change in average lifetime BLLs for adults who experience a change in water lead concentration as a result of pitcher filter use, LSL/GRR service line removal and/or installation of CCT or POU, rather than the set of initial LSL/GRR service line and CCT status combinations. Expected changes on average for all adults 40-80 due to changes in water concentrations due to the rule are displayed in Exhibit 5-23.

Exhibit 5-23: Estimated Lifetime Average Blood Lead Level Decrease for Adults Experiencing Alternate LSL/GRR, CCT, pitcher filter and POU Status Combinations

Pre-Rule Drinking Water			Post-Rule Drinking Water			Estimated Decrease in the Means of Blood Lead	
Lead Conc. (µg/L)	LSL Status	CCT Status	Lead Conc. (µg/L)	LSL Status	CCT Status	FEMALE: Ages 40-80 (µg/dL)	MALE: Ages 40-80 (µg/dL)
14.38	LSL	None	0.83	No LSL	None	1.36	1.05
14.38	LSL	None	4.27	LSL	Representative	1.01	0.78
14.38	LSL	None	0.83	No LSL	Representative	1.36	1.05
14.38	LSL	None	0.83	POU or pitcher filter		1.36	1.05
6.85	Partial/GRR	None	0.83	No LSL	None	0.6	0.47
6.85	Partial/GRR	None	2.14	Partial	Representative	0.47	0.37
6.85	Partial/GRR	None	0.83	No LSL	Representative	0.6	0.47
6.85	Partial/GRR	None	0.83	POU or pitcher filter		0.6	0.47
0.83	No LSL	None	0.83	No LSL	Representative	0	0
0.83	No LSL	None	0.83	POU or pitcher filter		0	0
7.93	LSL	Partial	0.83	No LSL	Partial	0.71	0.55
7.93	LSL	Partial	4.27	LSL	Representative	0.37	0.28
7.93	LSL	Partial	0.83	No LSL	Representative	0.71	0.55
7.93	LSL	Partial	0.83	POU or pitcher filter		0.71	0.55
3.84	Partial/GRR	Partial	0.83	No LSL	Partial	0.3	0.23
3.84	Partial/GRR	Partial	2.14	Partial	Representative	0.17	0.13
3.84	Partial/GRR	Partial	0.83	No LSL	Representative	0.3	0.23
3.84	Partial/GRR	Partial	0.83	POU or pitcher filter		0.3	0.23
0.83	No LSL	Partial	0.83	No LSL	Representative	0	0

Pre-Rule Drinking Water			Post-Rule Drinking Water			Estimated Decrease in the Means of Blood Lead	
Lead Conc. (µg/L)	LSL Status	CCT Status	Lead Conc. (µg/L)	LSL Status	CCT Status	FEMALE: Ages 40-80 (µg/dL)	MALE: Ages 40-80 (µg/dL)
0.83	No LSL	Partial	0.83	POU or pitcher filter		0	0
4.27	LSL	Representative	0.83	No LSL	Representative	0.35	0.27
4.27	LSL	Representative	0.83	POU or pitcher filter		0.35	0.27
2.14	Partial/GRR	Representative	0.83	No LSL	Representative	0.13	0.1
2.14	Partial/GRR	Representative	0.83	POU or pitcher filter		0.13	0.1
0.83	No LSL	Representative	0.83	POU or pitcher filter		0	0

Acronyms: LSL = lead service line; CCT = corrosion control treatment; POU = point-of-use; GRR = galvanized requiring replacement

5.5 Concentration Response Functions and Valuations used in the Estimation of Benefits to Children and Adults

The EPA undertook a rigorous process to identify concentration response functions to quantify benefits. This included reviewing all available studies which could be used to develop quantitative relationships between changes in lead exposure and/or changes in blood lead levels and changes in health endpoints. The EPA evaluated the studies for quality and potential biases. The EPA then developed a separate report for each health endpoint. In addition to the quality review findings, each report provides quantitative estimates, based on the identified functions, of potential changes in the health endpoint and was reviewed by EPA experts and/or externally peer reviewed. For the final LCRI the EPA has relied on concentration response functions for four quantified health endpoints that have been extensively reviewed by the agency and in the case of reductions in IQ losses, low birth weight and cardiovascular disease premature mortality, externally peer reviewed. Also, the approach used for IQ has been used in multiple prior rulemakings and undergone SAB review.

As with costs, the EPA estimated both high and low benefit scenarios for each health endpoint that is quantified. For lower birth weight, only one concentration response function was determined to be of high-quality, so this is used in both the high and low benefit scenario calculations. For IQ, ADHD, and CVD premature mortality, two or more functions were available, and the EPA selected the functions that gave the highest and lowest health benefit estimates across most blood lead levels.[173] For information on the uncertainties associated with the use of the selected concentration response functions see Section 5.7. The monetized benefit estimates provided in this chapter use the 2 percent discount rate as prescribed by the Office of Management and Budget's updated Circular A-4 (OMB Circular A-4, 2023).[174]

[173] As some of the functions are not linear, there are cases where these functions may not always give the highest or the lowest benefits.
[174] Because the EPA provided benefit estimates discounted at 3 and 7 percent for the proposed LCRI based on OMB guidance which was in effect at the time of the proposed rule analysis (OMB Circular A-4, 2003), the agency has also calculated the benefit impacts at both the 3 and 7 percent discount rates. See Appendix F for results.

5.5.1 *Concentration-Response Functions for Lead and IQ*

Previously, to estimate benefits supporting the 2021 LCRR, the EPA used a function based on Crump et al. (2013) in the main analysis and explored the choice of two additional IQ functions in the sensitivity analysis. Both functions in the sensitivity used the corrected Lanphear et al. (2005) function, as reported in Kirrane and Patel (2014): one with a low-dose linearization and the other without a low-dose linearization. To estimate avoided IQ loss in children for the final LCRI, the EPA selected two concentration-response functions. The low scenario benefits estimate is based on the study by Crump et al. (2013). The EPA chose the corrected Lanphear et al (2005, erratum 2019) function without low-dose extrapolation for the calculation of the high scenario benefit estimate for avoided IQ loss under the final LCRI. These studies were included in the EPA's SAB review of the 2021 LCRR (USEPA, 2020b).

This section provides an overview of these two key studies. Additional details of Crump et al. (2013) and Lanphear et al. erratum (2019) can be found in Appendix J of the Final 2021 LCRR EA (USEPA, 2020a), which provides more in-depth summaries of the key studies used in the concentration-response functions for the benefits analysis, as well as the Kirrane and Patel (2014) correction to the Lanphear et al. (2005) results, which was conducted prior to the publication of the Lanphear erratum.

Lanphear et al. erratum (2019) conducted a pooled analysis of seven international cohort studies that investigated the relationship between BLLs and full-scale IQ (the composite of verbal and performance IQ scores) in children 5–10 years old. The pooled study sample comprised 1,333 children, with a lifetime average BLL of 12.4 µg/dL. All the children underwent IQ testing with the Wechsler Intelligence Scale for Children. The mean IQ in the study sample was approximately 93 points. Associations between IQ and four different measures of BLLs in children were examined: concurrent (measurement obtained closest to the IQ test), maximum (peak value at any time before the IQ test), early (mean BLL from 6 to 24 months of age), and lifetime (mean BLL from 6 months of age to concurrent). For each of these measures, Lanphear et al. erratum (2019) estimated the relationship between BLLs and IQ by constructing an adjusted log-linear model.

Results of the Lanphear et al. erratum (2019) study showed that all blood lead measures were significantly associated with IQ loss, and were highly correlated with one another. Based on the R^2 values for each regression model (data not presented in the paper), Lanphear et al. erratum (2019) determined that concurrent BLLs were the strongest predictors of IQ, followed by lifetime average BLLs.

Exhibit 5-24 shows the beta estimates for the log-linear associations between each of the blood lead measures examined in Lanphear et al. erratum (2019). The estimated decreases in IQ associated with increases in concurrent BLLs from 2.4 to 10 µg/dL, 10 to 20 µg/dL, and 20 to 30 µg/dL were 3.8, 1.8, and 1.1 points, respectively. Consistent with the log-linear model, IQ deficits were greater at lower levels of lead exposures.

Changes in IQ associated with changes in BLLs for the high benefits scenario were estimated using Equation 9 below. Average BLLs for children age 0-7 (lifetime exposure) from the SHEDS-Pb modeling were used as inputs to the equation.

$$IQ\ Loss = \beta \times \ln\left(\frac{PbB_1}{PbB_2}\right) \quad \text{(Equation 9)}$$

Where:

β = Corrected lifetime beta estimate from Lanphear et al. (-3.25)

PbB_1 = Pre-rule BLL

PbB_2 = Post-rule BLL

In their 2013 paper, Crump et al. had two aims: 1) to perform a reanalysis of the methods in Lanphear et al. (2005), and 2) to conduct an independent analysis of the data from Lanphear et al. (2005). In the reanalysis, Crump et al. (2013) identified a few minor errors in the original Lanphear et al. (2005) paper. The correction of these minor errors resulted in slight changes to the regression coefficients but did not affect the main conclusions of the paper. These errors were confirmed by the EPA in a reanalysis by Kirrane and Patel (2014), which also reaffirmed that the main conclusions of Lanphear et al. (2005) remained unchanged, and Lanphear et al. erratum (2019) confirmed this in an *Erratum* of the original study. Kirrane and Patel (2014) additionally found that the early childhood blood lead measure had the highest R^2 value, though all R^2 values were similar.

In their independent analysis, Crump et al. (2013) made changes to the dataset used for final analysis (e.g., in selecting IQ measurements and defining blood lead measurements). Additionally, the authors opted to add 1 to the BLLs before log-transformation so that IQ loss was equal to 0 when BLL was 0, as shown in Equation 10.

$$IQ\ Loss = \beta \times \ln\left(\frac{PbB_1 + 1}{PbB_2 + 1}\right) \quad \text{(Equation 10)}$$

Where:

β = Lifetime beta estimate from Crump et al. (2013) independent analysis (-3.25)

PbB_1 = Pre-rule BLL

PbB_2 = Post-rule BLL

Changes in IQ associated with changes in BLLs for the low benefits scenario were estimated using Equation 10 based on the Crump independent analysis. As with the high benefit scenario, average BLLs for children ages 0-7 from the SHEDS-Pb model were used as inputs to the Equation 10.

For both equations, the SHEDS-Pb model estimated pre and post rule BLLs in children ages 0-7 are described in Section 5.4.

Exhibit 5-24: Comparison of Adjusted Coefficients from Lanphear et al. Erratum (2019) with Those Obtained in the Kirrane and Patel (2014), and the Reanalysis and Independent Analysis of Lanphear et al. (2005) by Crump et al. (2013)

BLL Variable	Kirrane and Patel (2014)		Lanphear et al. Erratum (2019)		Crump et al. (2013) Reanalysis ln(BLL)		Crump et al. (2013) Independent Analysis ln(BLL + 1)	
	β (95% CI)	R^2	β (95% CI)	R^{2a}	β (95% CI)	R^2	β (95% CI)	R^2
Early	-2.21 (-3.38, -1.04)	0.643	-2.21 (-3.38, -1.04)	n/a	-2.21 (-3.38, -1.03)	0.643	-2.46 (-3.82, -1.10)	0.659
Peak	-2.86 (-4.10, -1.61)	0.640	-2.86 (-4.10, -1.61)	n/a	-2.86 (-4.10, -1.61)	0.640	-2.48 (-3.83, -1.14)	0.656
Lifetime	-3.14 (-4.39, -1.88)	0.641	-3.25 (-4.51, -1.99)	n/a	-3.19 (-4.45, -1.94)	0.641	-3.25 (-4.66, -1.83)	0.659
Concurrent	-2.65 (-3.69, -1.61)	0.641	-2.65 (-3.69, -1.61)	n/a	-2.65 (-3.69, -1.61)	0.641	-3.32 (-4.55, -2.08)	0.658

Sources: Crump et al. (2013, Table 2 and Table 5), Kirrane and Patel (2014, Table 1), Lanphear et al. erratum (2019, Table 4).
[a] R^2 not reported in Lanphear et al. erratum (2019); however, the paper reported that the concurrent BLL was the largest R^2.
Notes: This table displays regression coefficients and R^2 values for the Lanphear et al. erratum (2019) analysis, the Crump et al. (2013) and Kirrane and Patel (2014) reanalysis of Lanphear et al. (2005), and the Crump et al. (2013) independent analysis of Lanphear et al. (2005). This table summarizes the relationship between BLL and IQ loss across various blood lead metrics.

As can be seen in Exhibit 5-24, the R^2 values are all similar: the strength of the relationship between BLLs and IQ loss appears to be similar regardless of the blood lead metric used. Because lifetime average BLLs are more reflective of the long-term changes in lead exposure anticipated under the final LCRI, the EPA chose to model the benefits under both the low and high benefit scenarios based on lifetime BLLs rather than concurrent BLLs.

No threshold has been identified for the neurological effects of lead (Schwartz and Otto, 1991; Budtz-Jørgensen et al., 2013; Crump et al., 2013; USEPA, 2024). Therefore, the EPA assumes that there is no threshold for this endpoint and quantified avoided IQ loss associated with all BLLs (Schwartz and Otto, 1991; Budtz-Jørgensen et al., 2013; Crump et al., 2013; USEPA, 2024). Budtz-Jørgensen et al. (2013), as well as the smaller cohort study of Min et al. (2009), used more recent BLLs than those used in the Crump and Lanphear analyses, and confirmed the results in Crump et al. (2013) and Lanphear et al. erratum (2019). Additionally, in Min et al. (2009), the steeper slopes at lower BLLs without log-transformation show increased IQ deficits, which provides additional evidence that reducing lead levels in the lower range of average BLLs has a significant impact on preventing IQ loss.

5.5.2 Valuation of Avoided IQ Loss

The economics literature provides a robust basis for estimating the relationship between IQ change and lifetime earnings. Because the literature relies on large datasets that are representative of the US population, it is appropriate to use the results to infer subpopulation-level impacts (though individual-level impacts) from changes in environmental policy, even when average impacts are very small in magnitude. The estimated effects of IQ on lifetime earnings are not predicated on a particular type or

pathway of pollutant exposure. Rather, they are broadly applicable to evaluating any type of policy intended to improve children's cognitive development (Lin et al. 2018).

The value of an IQ point used in the main analysis (both high and low scenarios) is derived from the EPA's (2019a) reanalysis of Salkever (1995), which estimates that a one-point change in IQ results in a mean 1.9 percent change in lifetime earnings for males and a mean 3.4 percent change in lifetime earnings for females. Lifetime earnings are estimated using the average of 10 American Community Survey (ACS) single-year samples (2008 to 2017) and projected cohort life tables from the Social Security Administration. Projected increases in lifetime earnings are then adjusted for direct costs of additional years of education and forgone earnings while in school. The USEPA (2019) reanalysis of Salkever (1995) estimates a mean change of 0.08 years of schooling per change in IQ point resulting from a reduction in lead exposure for males and a mean change of 0.09 years of schooling for females. This approach was reviewed by the EPA's SAB (USEPA, 2020b).

To estimate the uncertainty underlying the model parameters of the Salkever (1995) reanalysis, USEPA (2019a) used a bootstrap approach to estimate a distribution of model parameters over 10,000 replicates (using random sampling with replacement). For each replicate, the net monetized value of a one-point change in IQ is subsequently estimated as the gross value of an IQ point, less the value of additional education costs and lost earnings while in school.

Based on the mean value of the 10,000 sampling iterations, the USEPA (2019) estimated that the change in one IQ point discounted to age 7 is $42,226, in 2022 dollars, using a 2 percent discount rate. Note that the EPA's use of the term "2 percent discount rate" with regard to the calculation of the IQ point high and low values (which represent the present value of the change in lifetime earnings) is shorthand for a declining discount rate which begins with a 2 percent discount rate for the years 2024-2079, a 1.9 percent discount rate used for the years 2080-2096, and a 1.8 percent discount rate used in years 2095-2102. This declining rate structure was implemented to comply with updates to OMB Circular A-4 guidance which indicates that a declining discount rate may be used to capture the uncertainty in the appropriate discount rate over long time horizons like lifetime labor force participation.[175][176]

The Salkever IQ value is presented in 2022 dollars to be consistent with the cost estimates. As described in Section 5.6, benefits are further discounted back to year one of the analysis and annualized within the SafeWater LCR model. A summary of the Salkever component values, by sex, can be found in Exhibit 5-25.

[175] The revised Circular A-4 discusses discounting over long time horizons (OMB Circular A-4 2023). As noted by OMB in the updated Circular A-4, "[t]here are various reasonable approaches to long-term discounting that account for uncertainty and other relevant factors, and therefore lead to dynamic discount rates over time." When the time horizon of an analysis is sufficiently long (i.e., 2080 or beyond), use of a declining discount rate may be appropriate to capture uncertainty in the discount rate over long time horizons.

[176] Note that the declining discount rate structure was not used in the proposed rule calculation of IQ point values and the EPA has continued to use the constant discount rate IQ point values in the 3 and 7 percent benefit calculations found in Appendix F.

Exhibit 5-25 Updated Estimates for Lifetime Earnings, Additional Education Costs, and Lost Earnings from Additional Education (2022 USD), discounted at 2 percent to age 7

Estimate	Updated Salkever Estimates		
	Male	Female	Male and Female Combined
1. Lifetime Earnings	$2,174,849	$1,424,497	-
2. IQ Effect	1.87%	3.41%	-
3. IQ Effect*Lifetime Earnings	$40,700	$48,559	$44,551
4. Additional Education Costs	$1,702	$1,940	$1,819
5. Lost Earnings (from additional education)	$594	$415	$506
6. Value of an IQ Point (3 - (4+5))	**$38,404**	**$46,204**	**$42,226**

Note: The EPA uses of the term "2 percent discount rate" with regard to the calculation of the IQ point high and low estimates is shorthand for a declining discount rate which begins with a 2 percent discount rate for the years 2024-2079, a 1.9 percent discount rate used for the years 2080-2096, and a 1.8 percent discount rate used in years 2095-2102. This declining rate structure was implemented to comply with updates to OMB Circular A-4 guidance.

See Appendix F for a Sensitivity Analysis with an alternative value for IQ benefits based on Lin et. al. (2018). For additional discussion of the methods, also see Appendix J of the Final 2021 LCRR EA (USEPA, 2020a) and Appendix A of USEPA (2024c).

5.5.3 Concentration-Response Function for Lead and ADHD

This is the first regulation in which the EPA has estimated benefits of avoided cases of ADHD associated with reductions in lead exposure; as discussed below the approach for quantifying such benefits will continue to evolve as our understanding of the potential relationship improves. As described in Appendix D the USEPA (2024b) ISA strengthened the conclusions of the 2013 ISA and concluded that there was a causal relationship between lead exposure and inattention, impulsivity, and hyperactivity in children based on recent studies of children with group mean BLLs ≤5 µg/dL. The 2024 ISA states that "prospective studies of ADHD, including a study of clinical ADHD that controlled for parental education and SES [Socioeconomic status], although not quality of parental caregiving reported positive associations" (USEPA, 2024b. p. IS-30).The causes of ADHD are not fully understood, but research suggests a number of potential causes, including genetics, exposure to environmental toxins, prenatal cigarette smoking or alcohol intake, and brain changes (Tripp and Wickens, 2009; Pliszka et al., 2007). The EPA's 2013 lead ISA statedthat in children, "attention was associated with biomarkers of Pb exposure representing several different lifestages and time periods. Prospective studies did not examine a detailed Pb biomarker history, and results do not identify an individual critical lifestage, time period, or

duration of Pb exposure associated with attention decrements in children. Associations in prospective studies for attention decrements with tooth Pb level, early childhood average and lifetime average blood Pb levels point to an effect of cumulative Pb exposure." The 2024 ISA addresses the uncertainties presented in the 2013 ISA by stating that "The largest uncertainty addressed by the recent evidence base is the previous lack of prospective studies examining ADHD (Appendix 3.5.2.4–3.5.2.5). The bulk of the recent evidence comprises prospective studies that establish the temporality of the association between Pb [lead] exposure and parent or teacher ratings of ADHD symptoms and clinical ADHD. Across studies, associations were observed with tooth Pb concentrations, childhood BLLs (<6 µg/dL), and with maternal or cord BLLs (2–5 µg/dL)." The available studies relating blood lead to ADHD use one-time BLLs, while it is possible that cumulative exposure is also important. However, one-time and cumulative measures of BLLs in children are often correlated. Therefore, the EPA has chosen diagnosed cases of ADHD as an endpoint in this benefits analysis, because literature exists linking ADHD diagnosis to these monetizable outcomes. The larger body of literature on attention, impulsivity, and hyperactivity symptoms in children supports this association. The EPA chose a higher and lower concentration-response function for the estimates of avoided cases to partially address the uncertainty in the most appropriate function to use in estimating avoided cases due to the rule. Additional future research will help to further understand the critical exposure window (thus exposure metric), the mode of action of lead in the development of ADHD and/or related symptoms, and the interplay with genetic factors and exposures to other substances.

The approach used to quantify ADHD here is based on review and analysis that Abt Associates (Abt Associates, 2022a) conducted under contract to the EPA.

For the LCRI, the EPA estimates the benefits based on avoided cases of ADHD in children due to the rule. The EPA chose a higher and lower concentration-response function for the estimates of avoided cases to partially address the uncertainty in the most appropriate function to use in estimating avoided cases due to the final rule.

This section provides a brief overview of two studies that inform the high and low benefit estimates for ADHD. Froehlich et al. (2009) forms the basis of the high benefits estimates, and Ji et al. (2018) forms the basis of the low benefits estimates. The selection of these studies is summarized in a report prepared for the EPA (Abt Associates, 2022a) Additionally, see Section 5.7.5 for a discussion on the strengthened evidence addressing the uncertainty in the relationship between Pb and ADHD presented in the 2024 Pb ISA.

Froehlich et al. (2009) aimed to investigate the associations between ADHD and childhood lead exposures, both independently and in combination with prenatal tobacco exposures. The authors analyzed data from 2001-2004 NHANES on 2,588 children aged 8 to 15 years old with complete information on ADHD diagnosis, lead and tobacco exposures, and additional covariates. Children with high serum cotinine levels (>10 ng/mL), were excluded from the study to prevent confounding of the effects of secondhand tobacco exposure. In the main analyses, ADHD diagnosis in NHANES was based on completion of the Diagnostic Interview Schedule for Children (DISC) by caregivers. The DISC is a structured interview that contains questions on ADHD symptoms, onset, pervasiveness, and severity in the last 12 months and uses DSM-IV[177] criteria to diagnose ADHD. As a secondary outcome, the

[177] Diagnostic and Statistical Manual of Mental Disorders

definition of ADHD diagnosis was expanded to capture children with ADHD who did not meet full DSM-IV criteria due to appropriate medication treatment. In these secondary analyses, children that had a caregiver report both a history of ADHD diagnosis and ADHD medication use in the past year were additionally included in the analyses. The authors investigated variables that had previously been shown to be associated with ADHD as potential confounders. In the secondary analyses, health insurance status was also examined as a covariate. Logistic regression analyses were used to examine associations between lead exposures and ADHD, adjusted for confounders that were confirmed to be significantly associated with ADHD (χ^2 test, $p < 0.2$). The final logistic regression model was adjusted for sex, age, race/ethnicity, preschool attendance, birth weight[178], income/poverty ratio, maternal age at child's birth, and both current secondhand and prenatal tobacco exposures (operationalized by serum cotinine levels and via maternal report, respectively). Additional analyses were performed restricting the sample to children with blood lead < 5 µg/dL. Joint toxicant (i.e., both lead and tobacco exposure) effects were assessed by examining ADHD incidence at varying levels of co-exposures.

Froehlich et al. (2009) found that 8.7% of children studied met DSM-IV criteria for ADHD diagnosis. Children in the highest tertile of lead exposure (>1.3 µg/dL) were 2.3 times more likely to be diagnosed with ADHD (95% CI, 1.5-3.8) than children in the lowest tertile (0.2 to 0.8 µg/dL). The same adjusted odds ratio (OR) was observed when restricting the sample to children with blood lead < 5 µg/dL. When blood lead was logarithmically transformed and analyzed as a continuous variable, the adjusted OR for ADHD diagnosis was 1.8 (95% CI, 1.2-2.8) given a one-unit increase in natural log blood lead[179]. The significant association between lead exposures and ADHD remained when the definition of ADHD diagnosis was expanded in the secondary analyses: the adjusted OR was 2.0 (95% CI, 1.3-3.0). Childhood lead and prenatal tobacco exposures combined had a multiplicative effect on the risk of ADHD. Froehlich et al. (2009) estimated that 25% of ADHD cases among U.S. children with blood lead > 1.3 µg/dL are attributable to lead exposures, corresponding to approximately 598,000 cases.

Results of Froehlich et al. (2009) were consistent with prior studies that found a relationship between childhood lead exposures and DSM-IV ADHD diagnosis. The use of a national, population-based sample of children with low blood lead makes results generalizable to the U.S. population of children. The possibility of residual confounding from unmeasured genetic and environmental confounders (e.g., prenatal alcohol exposure) or parental characteristics remains. Because of small sample sizes for each subtype, the authors could not investigate associations between blood lead and specific ADHD subtypes.

Ji et al. (2018) investigated the relationship between early childhood exposure to lead (blood leads were measured prior to age 4) and the risk of being diagnosed with ADHD using a prospective cohort design, including effect modification by sex, maternal high density lipoprotein (HDL) levels, and stress during pregnancy. Data from the Boston Birth Cohort were utilized in this study. The Boston Birth Cohort includes mother-infant pairs enrolled at birth from the Boston Medical Center. Enrollment is on a rolling basis since 1998, and at the time of this study 3098 mother-infant pairs had enrolled in the post-natal follow-up study. After excluding mother-infant pairs due to missing data, lead measurements taken after an ADHD diagnosis, incorrect measurement dates, age over 4 years at measurement, and lead levels higher than 10 µg/dL, the final analysis including 1479 pairs.

[178] Birth weight could be one pathway through which Pb exposure affects ADHD.
[179] Per Joseph Braun, personal communication to Meghan Lynch

Data were collected using a questionnaire, electronic medical records, and maternal blood samples obtained 24 to 72 hours after delivery. A questionnaire was used to collect data from mothers on demographic characteristics, stress during pregnancy, and smoking status. Birthweight, gestational age, parity, intrauterine infections, complications, child lead levels, and ADHD diagnostic codes were obtained from electronic medical records. If a child had repeated lead measures, the earliest measurement taken was used for analysis. If a child's electronic medical record contained a diagnostic code for ADHD, the child was enrolled in the ADHD group. Children in the neurotypical group were not diagnosed with any of the ADHD codes, nor were they diagnosed with autism spectrum disorder, conduct disorders, developmental delays or intellectual disabilities, failure to thrive or congenital anomalies. HDL and lead levels were measured in maternal blood samples taken between 24 to 72 hours after delivery.

To examine the concentration-response relationship between lead and ADHD diagnosis, the authors used categorical and continuous multiple logistic regression, and adjusted for maternal age at delivery, mode of delivery, maternal race/ethnicity and education, smoking status during pregnancy, intrauterine infection, parity, child's sex, preterm birth, and birthweight in all models (except sex when it was included as joint or interaction term in the models). Additional analyses were conducted to investigate the effects of sex on the lead-ADHD relationship.

Ji et al. (2018) found elevated lead levels at 5-10 µg/dL were associated with a 66% increase in risk of an ADHD diagnosis, OR=1.66 (95% CI, 1.0-2.56), compared to children with lead levels less than 5 µg/dL. The natural log-transformed linear lead levels were associated with an increased risk of ADHD diagnosis (OR=1.25, 95% CI, 1.01-1.56). In joint association analyses, the effects of lead on the risk of ADHD diagnosis were attenuated in both stratified and joint effects models for females. For males, risk of ADHD diagnosis was 2.5 times higher when lead levels were 5-10 µg/dL compared to lead levels <5 µg/dL (OR=2.49, 95% CI, 1.46-4.26). Findings were similar in Cox proportional hazards models.

This main health impact function is applied to both the Froehlich et al. (2009) and Ji et al. (2018) studies[180]. Regression coefficients (βs) are summarized below the equation.

$$\Delta \boldsymbol{ADHD} = \left[\boldsymbol{p_0} - \frac{\boldsymbol{p_0}}{(\mathbf{1} - \boldsymbol{p_0}) \times \boldsymbol{e}^{-\boldsymbol{\beta_1}[\ln(\boldsymbol{Blood\ Pb_i}) - \ln(\boldsymbol{Blood\ Pb_f})]} + \boldsymbol{p_0}}\right] \times \boldsymbol{pop} \qquad \text{(Equation 11)}$$

Where:

p_0 = Baseline rate of ADHD in the population of interest

β_1 = Beta estimate from study: 0.223 using Ji et al. (2018) or 0.588 using Froelich et al. (2009)

$Blood\ Pb_i$= Initial blood lead (µg/dL)

$Blood\ Pb_f$= Final blood lead (µg/dL)

pop = Number of children in the population of interest

[180] A derivation of this function can be found in Abt Associates (2023).

Ji et al. (2018) measured early childhood BLLs, therefore, in the SafeWater LCR model analyses (see Section 5.6) the blood lead outputs from the SHEDS-Pb models were used, as these are more relevant to younger children. Benefits based on Ji et al. (2018) are captured at age 7, assuming all children over the analysis period are diagnosed with ADHD at age 7. This is the basis of the low benefits estimates for ADHD.

Froelich et al. (2009) measured BLLs in children ages 8-15. Therefore, output from the AALM model was used in the SafeWater LCR model analyses to estimate BLLs in that age group. Benefits using Froelich et al. (2009) are captured at age 11, assuming all children over the analysis period are diagnosed with ADHD at age 11.

For both the high and low benefit calculations, the baseline rate of ADHD is assumed to be 9.6 percent based on Danielson et al. (2018).[181]

5.5.4 Valuation of Avoided ADHD

This analysis applies a valuation for ADHD cases based on a study by Doshi et al. (2012) following a similar approach to that used in the EPA's (2023a) Economic Analysis of Updated Soil Lead Guidance for Sites and Facilities Being Addressed Under CERCLA and RCRA Authorities.

To value each case of ADHD avoided, the USEPA (2023a) applied the following values obtained from Doshi et al. (2012) for annual per-person incremental costs in 2023 dollars covering the following cost categories:

- Children/Adolescent costs
  - Health care (patient); ages 0-21: $2,348
  - Health care (family); ages 0-18: $1,930
  - Productivity losses (family); ages 0-18: $326
  - Education; ages 5-18: $4,680
  - Justice system; adolescents aged 13-17: $362

- Adult costs
  - Health care (patient); ages 18-64: $2,680
  - Health care (family); ages 19-44: $1,330
  - Justice system; ages 18-28: $2,405

As described in Section 5.5.3 two different concentration response functions are used for the high and low scenarios. Ji et al. (2018) measured early childhood BLLs. Benefits based on Ji et al. (2018) are captured at age 7, assuming all children over the analysis period are diagnosed with ADHD at age 7. This is the basis of the low benefits estimates for ADHD. Froelich et al. (2009) measured BLLs in children ages 8-15. Benefits using Froelich et al. (2009) are captured at age 11, assuming all children over the analysis period are diagnosed with ADHD at age 11. Therefore, for the valuation in the low scenario, costs for

[181] Note the EPA updated the baseline rate of ADHD based on Danielson et al. (2018). In the EPA assessment for the "Updated Residential Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities" the agency used a baseline rate for ADHD of 10.2 percent from Xu et al. (2018).

children 0-6 are not included in the estimate. For the high scenario, costs for children 0-10 are not included in the estimate.

There is uncertainty about what percent of ADHD cases persist into adulthood. Therefore, for the final LCRI rule analysis, the EPA uses a high and low estimate of the ADHD cost of illness, based on a high and low estimate of ADHD persistence into adulthood.

The high analysis assumes that 90 percent of childhood cases of ADHD persist into adulthood, based on Sibley et al. (2022) and as used in USEPA (2024c). This assumption is used to adjust the healthcare and justice system benefits realized at ages 18 and older for an avoided case of ADHD diagnosed in childhood. The assumption is derived from Sibley et al. (2022)'s finding that 9.1 percent of childhood cases (mean age 8 years) recovered from ADHD at the study's final 16-year follow up (mean age 25 years, sample size 558). Recovery was defined as a full remission of ADHD sustained for at least two consecutive study assessments (conducted approximately every two years). However, the authors find that most cases have ADHD symptoms and impairments that fluctuate over time, and only a small percentage are stable into adulthood, either as persistent case or full recovery status. For example, at the final 16-year follow-up, 39.7 percent of participants were categorized as having persistent ADHD (defined using DSM-5 symptom thresholds) and 45.7 percent were categorized with partial remission. These participants were comprised of a mix of those with stable persistence (10.8%) or partial remission over all study time periods (15.6%), and a majority with fluctuating occurrence of symptoms over time (63.8%).

In sum, while this analysis assumes that 90 percent of childhood ADHD diagnoses persist into adulthood, only a fraction of those cases are likely to meet the full DSM diagnostic criteria and/or present stable symptoms in each year of adulthood. Thus, the high analysis may potentially overestimate ADHD benefits resulting from the final rule to the extent that these variances are not captured in the cost-of-illness estimates for the value of an avoided case of ADHD.

The low estimate is based on Barbaresi et al. (2013) which reports a 29.3 percent persistence rate, where persistence is defined according to the number of ADHD symptoms in adulthood that exceed two standard deviations of the mean number of symptoms in non-ADHD controls. Barbaresi et al. (2019) is based on a small sample size (367) and the population is nearly all white, and focused on Rochester, Minnesota, which the authors describe as geographically isolated in southeastern Minnesota. The study categorizes itself as the only study to not look at cases referred to a specialty treatment program. It is possible this is an underestimate of persistence given that it excludes some cases of partial ADHD symptoms, which are likely to yield social costs. Given the range of persistence into adulthood, the EPA chose 29% as the lower bound.

The high and low net present value estimates of all avoided ADHD costs incurred through age 64 are presented in Exhibit 5-26 in 2022 dollars. The values have been discounted back to age 7 for use with Ji et al. and back to age 11 for use with Froelich et al. using a 2 percent discount rate. Once captured, SafeWater further discounts back to the first analysis year. [182]

[182] Because the EPA provided benefit estimates discounted at 3 and 7 percent for the proposed LCRI based on OMB guidance which was in effect at the time of the proposed rule analysis (OMB Circular A-4, 2003), the agency has also calculated the ADHD benefit impacts at both the 3 and 7 percent discount rates. In the calculation of these

Exhibit 5-26: Present Value of Avoided ADHD Cases 2022 USD, Per Case

Assumed Persistence of ADHD Into Adulthood	Age at ADHD Diagnosis	2% Discount Rate
90%	11 (High- Froelich)	$184,149
29.3%	7 (Low- Ji)	$128,559

Note: The EPA uses of the term "2 percent discount rate" with regard to the calculation of the ADHD high and low estimates is shorthand for a declining discount rate which begins with a 2 percent discount rate for the years 2024-2079, a 1.9 percent discount rate used for the years 2080-2085. This declining rate structure was implemented to comply with updates to OMB Circular A-4 guidance.

5.5.5 Concentration-Response Function for Lead and Birth Weight of Infants Born to Women of Child-Bearing Age

In this analysis, women of childbearing age are represented by the population of women between the ages of 17-45 years old. The EPA utilized the AALM to generate estimates of blood lead in women of childbearing age. Zhu et al. (2010) was used to develop a concentration-response function for the birth weight of children born to these women for both the high and low benefit scenarios as this was the only study of suitable quality for benefits analysis (see Abt Associates, 2022b).[183]

Zhu et al.'s study, *Maternal Low-Level Lead Exposure and Fetal Growth* (2010), examined the association between low-level (<10 µg/dL) lead exposure and decreased fetal growth, specifically measures of birth weight, pre-term birth, and small for gestational age. In their retrospective cohort study, Zhu et al. matched the blood lead records from New York State's Heavy Metals Registry (HMR)[184] to birth certificate data for singleton births in the state of New York for 43,288 mother–infant pairs from upstate New York (New York State excluding New York City). The mothers were 15–49 years of age in 2003–2005.[185] The study restricted the cohort to mothers with blood lead levels < 10 µg/dL. The mean and median blood lead levels for the cohort were 2.1 µg/dL and 2 µg/dL, respectively. The mean birth weight was 3,331 grams.

To assess the relationship between maternal blood lead and the continuous outcomes (e.g., birth weight in grams), Zhu et al. (2010) used a multiple linear regression with fractional polynomials (Royston et al.

benefits the EPA has used ADHD case values that are derived by discounting at the constant 3 and 7 percent rates. See Appendix F for ADHD case values and benefit results discounted at 3 and 7 percent.

[183] An earlier version of this report describing the choice of Zhu et al. was peer reviewed in 2015 as part of the External Peer Review of the *EPA's Approach for Estimating Exposures and Incremental Health Effects from Lead due to Renovation, Repair, and Painting Activities in Public and Commercial Buildings,*

[184] Starting in 1992, New York State began requiring that all lead test results be reported to the HMR. The authors pulled data on potential confounding factors from the birth certificate files.

[185] For any individuals who had more than one blood lead measurement, a single measurement was selected at random. Additionally, for any mothers who had more than one child between 2003 and 2005, only one birth was selected, also at random.

1999). They explored one or two terms of fractional polynomials in terms of x^p where the power of p was -2, -1, -0.5, 0.5, 1, 2, and 3, and also used a natural logarithmic transformation of lead.[186]

The authors state that the model that assumed a linear relationship between birth weight and the square root of blood lead fit the data better than models with all other combinations of fractional polynomials. The final model developed by Zhu et al. (2010) was adjusted for timing of the lead test, gestational age, maternal age, race, Hispanic ethnicity, education, smoking, alcohol drinking, drug abuse, in wedlock, participation in special financial assistance program, parity, and infant sex. The concentration-response relationship from Zhu et al. is:

$$BW = b_0 + \left(-\frac{27.4\mathrm{g}}{\mu\frac{\mathrm{g}}{\mathrm{dL}}} \times PbB^{0.5}\right) \quad \text{(Equation 12)}$$

Where:

BW	=	Birth weight in grams
b_0	=	Birth weight when blood lead is equal to 0 µg/dL[187]
PbB	=	Blood lead in µg/dL

The results from the study are presented in Exhibit 5-27, which shows that changes in birth weight associated with a 1 µg/dL change in blood lead vary based on the starting blood lead concentration. For example, the reduction in birth weight from a change in blood lead from 0 to 2 µg/dL is approximately 40 grams and from 8 to 10 µg/dL is approximately 10 grams. As Zhu points out, “the model predicts the strongest estimated effects at the lowest levels of exposure, without a lower threshold of PbB [blood lead] below which there would be no predicted effect on birth weight” (p. 1473).

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[186] While 0.5 is not listed in the methods of Zhu et al. (2010), this is stated to be the resulting best fit model; therefore, it is included our list.
[187] The birthweight when blood lead is equal to zero was not provided in the paper however from Figure 1 it appears to be approximately 3,310 g.

Exhibit 5-27: Association between a Change in Blood Lead Concentration and Birth Weight, Upstate New York, 2003–2005 from Zhu et al. (2010)

Change in Blood Pb Concentration (µg/dL)	Estimate (grams)	95% CI (grams)
0	Reference	-
1	-27.4	-17.1 to -37.8
2	-38.8	-24.1 to -53.4
3	-47.5	-29.6 to -65.4
4	-54.8	-34.2 to -75.5
5	-61.3	-38.2 to -84.4
6	-67.2	-41.8 to -92.5
7	-72.5	-45.2 to -99.9
8	-77.6	-48.3 to -106.8
9	-82.3	-51.2 to -113.3
10	-86.7	-54.0 to -119.4

Source: Table 3 from Zhu et al. (2010).
Notes: 1) The model was a linear regression with fractional polynomials after adjustment for timing of Pb test, gestational age, maternal age, race, Hispanic ethnicity, education, smoking, alcohol and drinking, drug abuse, in wedlock, participation in special financial assistance programs, parity, and infant sex. Blood Pb concentration was transformed using a square root. The coefficient was -27.4 with a standard error (SE) of 5.3.
2) In the LCRI analysis, modeled blood lead levels do not exceed 2.35 µg/dL.

5.5.6 Valuation of Avoided Reductions in Birth Weight

The valuation of changes in birth weight is based on an approach further described in Abt Associates (2022c) which was finalized after undergoing peer review coordinated by the EPA.[188]Their analysis of U.S. Department of Health and Human Services, Medical Expenditure Panel Survey (MEPS) data found that birth weight in the very low birth weight (VLBW)/ low birth weight (LBW) and normal ranges influences medical expenditures. The report provides simulated cost changes based on inpatient hospital stays. Since these models were non-linear, Abt Associates (2022c) conducted simulations to understand the magnitude of the overall effect of birth weight on expenditures.

Using birth weight spline specifications, the authors found the simulated cost changes for increases in birth weight are negative and significant in the VLBW, LBW, and normal birth weight ranges in models that do not also control for a preterm birth indicator[189] (see Exhibit 5-28). The effects are largest at lower starting birth weights. For an increase of 0.22 lb, expenditures for inpatient hospital stays

[188] Note this methodology was externally peer review, see MDB Inc. (2022).
[189] Due to strong negative correlation between birth weight and preterm birth, there are fewer significant results in the VLBW range when the preterm indicator is included.

decrease by $1,652[190] at the VLBW threshold of 3.3 lbs, and less than $100 at the normal birth weight threshold of 5.5 lbs.

Exhibit 5-28: Simulated Cost Changes (2010 USD) on Annual Medical Expenditures for Inpatient Hospital Stays, using Birth Weight Spline Specifications (N with Positive Expenditures = 450)

Birth Weight (lbs)	BW Splines (excluding Preterm)		
	+0.04 lb	**+0.11 lb**	**+0.22 lb**
2	-974.24 (573.13)*	-2,375.82 (1,395.14)*	-4,560.19 (2,669.45)*
2.5	-663.98 (376.82)*	-1,618.46 (915.69)*	-3,104.15 (1,747.07)*
3	-449.22 (240.68)*	-1,094.45 (583.64)*	-2,097.43 (1,109.73)*
3.3	-354.03 (180.93)*	-862.28 (438.13)*	-1,651.66 (831.06)**
4	-200.83 (87.76)**	-488.77 (211.65)**	-935.06 (398.76)**
4.5	-132.60 (49.29)***	-322.52 (118.43)***	-616.44 (221.78)***
5	-86.76 (26.01)***	-210.92 (62.23)***	-402.74 (115.69)***
5.5	-16.35 (6.85)**	-40.55 (16.91)**	-79.99 (33.09)**
6	-14.42 (5.61)**	-35.75 (13.83)**	-70.51 (27.05)**
7	-11.18 (3.66)***	-27.71 (9.02)***	-54.65 (17.61)***
8	-8.64 (2.29)***	-21.41 (5.64)***	-42.21 (10.99)***
9	10.63 (9.96)	26.93 (25.51)	55.03 (53.17)
10	15.47 (22.73)	39.14 (58.63)	79.86 (123.71)

Notes: 1) Results show mean and standard error of the difference between simulated cost for baseline birthweight (left) and each birth weight increase. Significance estimates for the difference are indicated at the 1% (***), 5% (**), and 10% (*) levels.
2) Results are based on the log-log model (probability) and a gamma distribution (expenditures), which appear to fit the data best (see Appendix D). Estimates are averaged over all infants/toddlers (including those with and without non-zero expenditures) up to age two years.

[190] In 2010 United States Dollars.

Exhibit 5-29: Simulated Cost Changes (2010 USD) on Annual Medical Expenditures for Inpatient Hospital Stays, for Birth Weight Indicator and a Pre-term Indicator Only Model (N with Positive Expenditures = 450)

Change in Indicator Value	Model with Indicators for LBW and Preterm Birth		Model with LBW Indicator (excluding Preterm)	Model with Preterm Indicator (Excluding BW)
	Simulated Change: LBW	Simulated Change: Preterm	Simulated Change: LBW	Simulated Change: Preterm
0 to 1	3,088.13 (1,154.62)***	949.29 (359.67)***	4,203.38 (1,278.27)***	2,316.15 (563.47)***

Notes: 1) Results show mean and standard error of the difference between simulated cost at each indicator variable value (0 to 1 for either LBW or Preterm indicator variables). Significance is indicated at the 1% (***), 5% (**), and 10% (*) levels.
2) Results are based on the log-log model (probability) and a gamma distribution (expenditures), which appear to fit the data best (see Appendix D). Estimates are averaged over all infants/toddlers (including those with and without non-zero expenditures) up to age two years.

In the SafeWater LCR model, costs are inflated to 2022 dollars in order to be consistent with the timeframe chosen for the regulatory analysis (using a multiplier based on GDP[191]).

Applying the cost of illness (COI) value in the benefits calculation is done by following the steps:

Step 1. Calculate the change in birth weight due to the rule. Outputs from Zhu et al. (2010) for each change in LSL/GRR service line, CCT, POU or pitcher filter use scenario provide this output.

Step 2. Calculate the valuation of the change in birth weight due to the rule based on the proportion of infants born at each birth weight. Because Abt Associates (2022) estimated COI values for three discrete changes in birth weight (0.04 lb, 0.11 lb, or 0.22 lb; or 20 grams, 50 grams, or 100 grams), this results in the assumption that changes in birth weight below 0.04 lb have no value[192], changes of 0.04 lb to below 0.11 lb have a value equal to the COI presented for 0.04 lb changes, changes of 0.11 lb to below 0.22 lb have a value equal to the COI presented for 0.11 lb changes, and changes of 0.22 lb and above have a value equal to the COI presented for 0.22 lb changes. We assume that any change in birth weight resulting from the rule impacts infants with baseline birth weights equal to the distribution of birth weights in the United States (see Exhibit 5-30. Using this distribution, the EPA calculates the valuation of the change in birth weight due to the rule using the following equation:

[191] The EPA used the U.S. Bureau of Economic Analysis Table 1.1.9 Implicit Price Deflators for Gross Domestic Product (the May 30, 2024 revision) to adjust dollar values to 2022. See: https://apps.bea.gov/iTable/?reqid=19&step=3&isuri=1&1921=survey&1903=13#eyJhcHBpZCI6MTksInN0ZXBzIjpbMSwyLDMsM10sImRhdGEiOltbIk5JUEFfVGFibGVfTGlzdCIsIjEzIl0sWyJDYXRlZ29yaWVzIiwiU3VydmV5Il0sWyJGaXJzdF9ZZWFyIiwiMjAxNiJdLFsiTGFzdF9ZZWFyIiwiMjAyMiJdLFsiU2NhbGUiLCIwIl0sWyJTZXJpZXMiLCJBIl1dfQ==

[192] In reality, there is likely value below this level and therefore this analysis results in an underestimate of benefits.

$$\textbf{Value of Change in Birth Weight} = \sum_{bw2}^{bw10}\left(\left|VH_{bw,d} * P_{bw} * pop\right| + \left|2 * VB_{bw,d} * P_{bw} * pop\right|\right) \quad \text{(Equation 13)}$$

where:
$\sum_{bw2}^{bw10}$ = Sum of "value" equation above for each birth weight listed in Exhibit 5-30 below;
$VH_{bw,d}$ = Savings in initial birth-related hospital stay expenditures for the applicable 0.04 lb, 0.11 lb, or 0.22 lb birth weight change (*d*) for the applicable baseline birth weight (*bw*);
$VB_{bw,d}$ = Savings in annual hospital stay expenditures in the first two years of life for the applicable 0.04 lb, 0.11 lb, or 0.22 lb birth weight change (*d)* for the applicable baseline birth weight (*bw*);
P_{bw} = Proportion of total births that belong to a particular baseline birth weight (*bw*); and
pop = Number of children born to number of women of childbearing age in each option scenario (the annual fertility rate is 62.5 births per 1,000 women aged 15–44 in 2015).

Exhibit 5-30: Distribution of Birth Weights in the United States

Birth Weight (lbs)	Proportion of Total Births
2	0.7%
2.5	0.3%
3	0.3%
3.3	0.5%
4	0.9%
4.5	1.3%
5	2.4%
5.5	4.1%
6	13.5%
7	33.2%
8	29.4%
9	11.1%
10	2.4%

Source: Distribution based on CDC WONDER data for 2014 (CDC. 2015).

5.5.7 Concentration-Response Function for Lead and Cardiovascular Disease Premature Mortality

In their review of the proposed LCRR, the EPA's SAB stated, "benefits associated with reduced lead exposure and associated reduction in hypertension/cardiovascular effects have been well documented

(Chowdhury et al. 2018) and should be monetized and included in the EA" (USEPA, 2020b, p.15). For the LCRI, the EPA uses a methodology to estimate avoided cases of CVD premature mortality[193] due to reductions in lead exposures developed in Brown et al. (2020) and Abt Associates (2023).[194] In order to quantify the benefits of avoided cases of CVD premature mortality, Brown et al. (2020) and Abt Associates (2023) identified four studies providing a total of five concentration-response functions relating adult BLLs to CVD premature mortality. Because, uncertainty exists regarding the lead exposure level, timing, frequency, and duration contributing to the associations observed between a single adult blood lead measurement and CVD premature mortality (see Section 5.7.7), the EPA selected the two concentration-response functions that produced the highest and lowest estimated reduction in mortality, or benefits, from the identified functions. Aoki et al. (2016) was used for the low benefits estimates, and Lanphear et al. (2018) was used in the high benefits estimates. The EPA will evaluate new and novel data as they become available, and will consider updating the methodology for estimating cardiovascular premature mortality effects of changes in adult lead exposure as appropriate.

The four evaluated studies – Menke et al. (2006), Aoki et al. (2016), Lanphear et al. (2018), and Ruiz-Hernandez et al. (2017) – all use regression models to relate log-transformed blood lead levels to CVD premature mortality. The concentration-response function associated with the relationship between blood lead and CVD premature mortality modeled in each study is:

$$\Delta CVD\ Premature\ Mortality = y_1 \left(1 - e^{\beta \log_z\left(\frac{x_2}{x_1}\right)}\right) \qquad \text{(Equation 14)}$$

Thus, the function necessary to estimate the number of cases associated with a change in blood lead levels is:

$$Cases\ Avoided = y_1 \left(1 - e^{\beta \log_z\left(\frac{x_2}{x_1}\right)}\right) * pop \qquad \text{(Equation 15)}$$

Where:

y_1 = Baseline hazard rate of CVD premature mortality in baseline scenario (i.e., without the rule)

β = Beta coefficient, which represents the change in CVD premature mortality per unit change in blood lead

$\log_z$ = Log transformation to the base z (e.g., $\log_{10}$)

x_2 = Blood lead level associated with the rule

x_1 = Blood lead level without the rule

[193]In 2020, the EPA's Science Advisory Board, in its review of the scientific and technical basis of the Lead and Copper Rule Revisions, recommended that the EPA quantify and monetize CVD premature mortality impacts in adults from reductions in lead in drinking water, citing "well documented" evidence of an association with cardiovascular impacts (EPA SAB, 2020).

[194] Note the Abt Associates (2023) methodology was externally peer reviewed. See the MDB, Inc. (2019) "Selection of Concentration-Response Functions between Lead Exposure and Adverse Health Outcomes for Use in Benefits Analysis: Cardiovascular-Disease Related Mortality" peer review documentation at https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NCEE&dirEntryID=342855

pop = Population for whom the change in blood lead occurs

Equation 16 can be used to estimate the avoided CVD premature mortality from reductions in blood lead.

The beta coefficient, β, varies based on the study in question and is calculated by:

$$\beta = \frac{\ln\,(Hazard\ ratio)}{\log_z(Fold\ increase\ in\ blood\ lead\ for\ hazard\ ratio)} \qquad \text{(Equation 16)}$$

For example, the beta from Aoki et al. (2016) is based on a hazard ratio of 1.44, which was derived from a 10-fold increase in blood lead levels. Thus, the beta coefficient is equal to ln(1.44)/$\log_{10}$(10), which is 0.36. Exhibit 5-31 displays the study-specific inputs for Equation 16 associated with all five concentration-response functions presented in Brown et al. (2020) and Abt Associates (2023).

Exhibit 5-31: Inputs to the Health Impact Function Based on Selected Studies

Variable	**Aoki et al. (2016)**	**Lanphear et al. (2018)**
		Blood Pb <5 µg/dL
Log transformation ($\log_z$)	**Log_{10}**	**Log_{10}**
Central beta (β) estimate	**0.36**	**0.96**
Lower beta (β) estimate (based on lower bound of 95% CI for HR)	**0.05**	**0.54**
Upper beta (β) estimate (based on upper bound of 95% CI for HR)	**0.68**	**1.37**

Sources: Aoki et al. (2016) and Lanphear et al. (2018).
Note: Bolding identifies the parameters used in the LCRI analysis. For full descriptions of these and the functions not used to quantify CVD premature mortality, see Brown et al. (2020)

5.5.8 Valuation of Avoided Cardiovascular Disease Premature Mortality

In the scientific literature, estimates of willingness to pay for small reductions in mortality risks are often referred to as the "value of a statistical life." This is because these values are typically reported in units that match the aggregate dollar amount that a large group of people would be willing to pay for a reduction in their individual risks of dying in a year, such that the EPA would expect one fewer death among the group during that year on average. This is best explained by way of an example. Suppose each person in a sample of 100,000 people were asked how much they would be willing to pay for a reduction in their individual risk of dying of 1 in 100,000, or 0.001 percent, over the next year. Since this reduction in risk would mean that the EPA would expect one fewer death among the sample of 100,000 people over the next year on average, this is sometimes described as "one statistical life saved." Now suppose that the average response to this hypothetical question was $100. Then the total dollar amount that the group would be willing to pay to save one statistical life in a year would be $100 per person × 100,000 people, or $10 million. This is what is meant by the "value of a statistical life." Importantly, this is not an estimate of how much money any single individual or group would be willing to pay to prevent the certain death of any particular person.

The EPA uses a value of a statistical life (VSL) of $12.98 million in 2022 dollars, which is estimated using the EPA's (2014) recommended VSL of $4.8 million in 1990 dollars and the EPA's (2014) recommended method for adjusting the VSL for income growth and inflation. The $4.8 million value in 1990 dollars is updated to the $12.98 million in 2022 dollars by adjusting for inflation using the U.S. Bureau of Labor Statistics' (2019) Consumer Price Index and adjusting for income growth using real GDP per capita and an income elasticity of 0.4.

5.6 National Level Benefits Estimates

5.6.1 Implementation of Benefit Calculations in the SafeWater LCR model

Benefits are estimated based on LSL/GRR service line replacements, installation of POU devices, distribution of pitcher filters and installation and re-optimization of CCT that occur over the 35-year analysis period.

Benefits are captured in the analysis for each endpoint at a specific age, therefore it is necessary to estimate the number of people of each age who are served by each PWS receiving a benefit from a change in the lead concentration of their drinking water. This is handled by multiplying the number of people experience a drinking water change by the proportion of people that age in the U.S. population. For example, in order to estimate the number of 7-year-olds receiving a benefit in a given year, the SafeWater LCR model takes the total population experiencing each water lead change and multiplies that figure by the proportion of the United States population that is 7 years of age. A similar calculation is done for the applicable ages for the additional endpoints.

Because the SafeWater LCR model follows the population for a period of 35 years, all children who lived in areas experiencing the water lead concentration change who are younger than 7 years of age would also accrue benefits in future years of the 35-year period, as well as children born after the change in lead concentration as long as they reach the age of 7 during the course of the 35-year period. However, the proportion of the total PWS population experiencing a change in lead concentration that receives an IQ benefit in a given year remains the same: approximately 1.34 percent (the percentage of 7-year-olds in the total United States population according to the 2020 United States Census). This is because both the age distribution and the population served by each PWS are assumed to remain constant over the analysis period. Children who turn 7 a year after an LSLR will receive a comparatively smaller benefit than children who are born after the LSLR, due to living a larger proportion of their life without the higher contribution of lead in their drinking water, and the resulting difference in BLLs between the with- and without-rule scenarios (without considering discounting). The EPA refers to these comparatively smaller benefits as "partial benefits." This same procedure is used for cases of ADHD avoided, and for prevention of lower birthweight. ADHD benefits are captured at age 7 for the low benefits estimate and age 11 for the high benefits estimate. For birth weight, benefits are captured once yearly based on the birth rate in women ages 17-45. For CVD premature mortality, benefits are captured yearly from ages 40-79.

The EPA does not assume that all homes with replaced LSLs have members living in the home eligible to experience all four health endpoints. Rather, the EPA assumes that the proportion of each age and sex (for adults) living in homes that are undergoing an LSLR is equal to the proportion of the United States population that is that age and sex. This assumption takes care of the need to model the movement of

children and adults in and out of homes in the community, as the proportion of the population in these age groups is assumed to remain constant. For example, for IQ, if there are 1,000 households being served by a PWS that underwent a change in lead concentration, approximately 1.34 percent of the population (the percent of the U.S. population 7 years of age) in those households would accrue benefit annually, regardless of which specific home being served by the PWS they lived in. The accrued benefit for those children who are served by a PWS that has undergone a change is then a function of changes in the average lifetime BLL of the children due to the change in lead concentration, and the subsequent avoided IQ loss.

The modeling assumption that the percentage of children and adults are evenly distributed across LSL and non-LSL households is necessary to estimate the national level impacts of the final LCRI requirements. At the national level, total benefits calculated using these assumptions can be accurate, however, please note that the potential geographic variability in the impacted population of children or adults will not be represented in this national scale model. For example, some geographic areas of the country may have higher or lower percentages of young children, receiving greater or fewer benefits from implementing lead concentration reducing actions like CCT and LSL/GRR service line replacement. This national scale model does not capture the potential local variation in the estimated unit benefits for a given unit of cost at the local level.

5.6.2 Monetized National Annual Benefits

As described in Section 5.3, the EPA estimated benefits corresponding to the low and high scenarios used to characterize uncertainty in the estimates Benefits are discounted back to year one of the analysis and annualized within the SafeWater LCR model. The EPA summed benefits for all years and all PWSs, and then annualized benefits for both the baseline 2021 LCRR and LCRI using a 2 percent discount rate.

- As described in Section 5.5.1 and Section 5.5.2, the EPA applied both a high and a low concentration-response function in order to estimate the reductions in IQ loss expected under the rule, and a value of an IQ. Avoided IQ loss was captured at age 7, using a 2 percent discount rate, benefits are further discounted, at 2 percent, back to year one of the analysis and annualized within the SafeWater LCR model.

- As described in Section 5.5.3, the EPA estimated avoided cases of ADHD with high and low assumptions for the concentration response function. These avoided cases of ADHD were captured at age 11 for the high function, and at age 7 for the low function, the difference is due to the timing and methods in the source studies. The dose-response functions measure the change in probability that an individual develops ADHD in their lifetime. This is a lifetime change in risk rather than an annual change. In the case of Froehlich et al. (2009), this is because the study measured prevalence rather than incidence. In this analysis, the EPA uses prevalence as the baseline rate of ADHD in both concentration-response functions. As described in Section 5.5.4, high and low values, estimated using a 2 percent discount rate but assuming different rates of ADHD persistence into adulthood, were applied to each avoided case of ADHD for the high and low scenario respectively. Benefits are further discounted back to year one of the analysis and annualized within the SafeWater LCR model using the 2 percent rate.

- As described in Section 5.5.5, the EPA used the same concentration-response function for low birth weight in both the high and low scenarios, as it was determined that only one study met the criteria for inclusion. In this case, the only differences between the high and low scenarios for calculating benefits are the estimated number of systems exceeding the action level, and therefore the number of people who experience benefits, are due to the cost assumptions (see Chapter 4, Section 4.2). Following the COI approach in Section 5.5.6 and further described in Abt Associates (2022c), the EPA valued the avoided reductions in birth weight due to exposures to women of childbearing age.
- As described in Section 5.5.7, the EPA also estimated a high and low benefit for avoided CVD premature mortality in adults ages 40-80. For each adult aged 40-80 during the analysis, annual avoided CVD premature mortality is calculated with Equation 12, using the yearly blood lead estimates produced by AALM for each age and sex, and the beta estimate from Aoki et al. (2016) (low estimate) or Lanphear et al (2018) (high estimate). Age- and sex-specific background rates of CVD premature mortality are used for the baseline rate obtained from CDC's Wonder (CDC. 2015) database. The available studies that link lead exposure to CVD premature mortality risk do not provide information about latency or cessation lag between exposure and mortality incidence. In Safewater LCR, the EPA made the assumption that the timing for the age of the individuals experiencing CVD premature mortality that is caused by lead is the same as the distribution of CVD premature mortality by age and sex for CVD premature mortality irrespective of the cause (the cases due to lead follow the same rate by age as all other CVD premature mortality). The EPA valued each avoided case of CVD premature mortality at $12.98 million (the EPA's value of a statistical life). The EPA then summed benefits for all years and all PWSs producing a net present value. Benefits were then annualized for baseline 2021 LCRR and the final LCRI. Benefits are presented at the 2 percent discount rate.

The national annual children's benefits for a 2 percent discount rate over the 35-year period of analysis are presented in Exhibit 5-32 for IQ, and Exhibit 5-33 for ADHD. The results for prevented reductions in birth weight in infants due to reduced exposures in women of childbearing age are presented in Exhibit 5-34 at a 2 percent discount rate. Benefits of avoided CVD premature mortality in adults ages 40-80 are presented in Exhibit 5-35 at a 2 percent discount rate.[195]

Exhibit 5-36 summarizes the quantified national benefits for all endpoints. Exhibit F-3 and Exhibit F-4 in Appendix F present the benefits of the final LCRI at the 3 and 7 percent discount rates under both the high and low scenarios.

[195] Because the EPA provided benefit estimates discounted at 3 and 7 percent for the proposed LCRI based on OMB guidance which was in effect at the time of the proposed rule analysis (OMB Circular A-4, 2003), the agency has also calculated the benefit impacts at both the 3 and 7 percent discount rates. See Appendix F for results.

Exhibit 5-32: Estimated National Annual Children's IQ Benefits, All PWSs, 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	LCRI	Incremental	Baseline	LCRI	Incremental
Annual IQ Point Decrement Avoided due to CCT	21,310	16,696	-4,614	59,586	45,371	-14,215
Annual Value of IQ Impacts Avoided due to CCT (millions of 2022 USD)	$824.8	$628.0	-$196.8	$2,306.1	$1,707.5	-$598.6
Annual IQ Point Decrement Avoided due to SLR	9,771	158,602	148,832	24,476	233,404	208,929
Annual Value of IQ Impacts Avoided due to SLR (millions of 2022 USD)	$381.2	$6,108.2	$5,727.0	$963.6	$8,988.7	$8,025.1
Annual IQ Point Decrement Avoided due to POU	61	8	-53	226	52	-173
Annual Value of IQ Impacts Avoided due to POU (millions of 2022 USD)	$2.5	$0.3	-$2.2	$9.3	$2.0	-$7.3
Annual IQ Point Decrement Avoided due to Filters	0	1,870	1,870	0	5,234	5,234
Annual Value of IQ Impacts Avoided due to Filters (millions of 2022 USD)	$0.0	$94.8	$94.8	$0.0	$264.8	$264.8
Total Annual Child Cognitive Development Benefits (millions of 2022 USD)	**$1,208.5**	**$6,831.3**	**$5,622.8**	**$3,279.0**	**$10,963.0**	**$7,684.0**

Acronyms: CCT = corrosion control treatment; IQ = Intelligence quotient; LCRI = Lead and Copper Rule Improvements; SLR = lead service line replacement; POU = point-of-use; PWSs = public water systems; USD = United States dollar.

Exhibit 5-33: Estimated National Annual Benefits of Avoided ADHD Cases, All PWSs, 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual Number of ADHD Cases Avoided due to CCT	192	151	-41	767	575	-192
Annual Value of ADHD Cases Avoided due to CCT (millions of 2022 USD)	$22.5	$17.1	-$5.4	$126.1	$91.9	-$34.2
Annual Number of ADHD Cases Avoided due to SLR	93	1,516	1,423	318	3,013	2,695
Annual Value of ADHD Cases Avoided due to SLR (millions of 2022 USD)	$11.0	$176.4	$165.4	$53.2	$491.7	$438.5
Annual Number of ADHD Cases Avoided due to POU	1	0	-1	3	1	-2
Annual Value of ADHD Cases Avoided due to POU (millions of 2022 USD)	$0.1	$0.0	-$0.1	$0.6	$0.1	-$0.5
Annual Number of ADHD Cases Avoided due to Filters	0	19	19	0	76	76
Annual Value of ADHD Cases Avoided due to Filters (millions of 2022 USD)	$0.0	$2.8	$2.8	$0.0	$15.8	$15.8
Total Annual Benefit of ADHD Cases Avoided (millions of 2022 USD)	**$33.6**	**$196.3**	**$162.7**	**$179.9**	**$599.5**	**$419.6**

Acronyms: ADHD = Attention-Deficit/Hyperactivity Disorder; CCT = corrosion control treatment; LCRI = Lead and Copper Rule Improvements; SLR = lead service line replacement; POU = point-of-use; PWSs = public water systems; USD = United States dollar.

Exhibit 5-34: Estimated National Annual Benefits of Low-Weight Births, All PWSs, 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	LCRI	Incremental	Baseline	LCRI	Incremental
Annual Number of Low-Weight Birth Cases Avoided due to CCT	146,324	113,761	-32,563	275,867	207,833	-68,034
Annual Value of Low-Weight Birth Cases Avoided due to CCT (millions of 2022 USD)	$0.7	$0.5	-$0.2	$1.3	$1.0	-$0.3
Annual Number of Low-Weight Birth Cases Avoided due to SLR	62,321	988,177	925,856	100,988	938,470	837,482
Annual Value of Low-Weight Birth Cases Avoided due to SLR (millions of 2022 USD)	$0.3	$4.8	$4.5	$0.5	$4.6	$4.1
Annual Number of Low-Weight Birth Cases Avoided due to POU	397	50	-347	987	235	-752
Annual Value of Low-Weight Birth Cases Avoided due to POU (millions of 2022 USD)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Annual Number of Low-Weight Birth Cases Avoided due to Filters	0	10,395	10,395	0	18,650	18,650
Annual Value of Low-Weight Birth Cases Avoided due to Filters (millions of 2022 USD)	$0.0	$0.1	$0.1	$0.0	$0.1	$0.1
Total Annual Benefit of Avoided Low Weight Births (millions of 2022 USD)	**$1.0**	**$5.4**	**$4.4**	**$1.8**	**$5.7**	**$3.9**

Acronyms: CCT = corrosion control treatment; LCRI = Lead and Copper Rule Improvements; SLR = lead service line replacement; POU = point-of-use; PWSs = public water systems; USD = United States dollar.

Exhibit 5-35: Estimated National Annual Benefits of Avoided from Cardiovascular Disease Premature Mortalities, All PWSs, 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual Number of CVD Premature Mortality Cases Avoided due to CCT	106	82	-24	518	388	-130
Annual Value of CVD Premature Mortality Cases Avoided due to CCT (millions of 2022 USD)	$1,228.4	$920.4	-$308.0	$5,987.9	$4,359.4	-$1,628.5
Annual Number of CVD Premature Mortality Cases Avoided due to SLR	44	731	687	184	1,756	1,572
Annual Value of CVD Premature Mortality Cases Avoided due to SLR (millions of 2022 USD)	$518.9	$8,393.9	$7,875.0	$2,166.0	$20,214.3	$18,048.3
Annual Number of CVD Premature Mortality Cases Avoided due to POU	0	0	0	2	0	-2
Annual Value of CVD Premature Mortality Cases Avoided due to POU (millions of 2022 USD)	$3.4	$0.4	-$3.0	$21.0	$4.4	-$16.6
Annual Number of CVD Premature Mortality Cases Avoided due to Filters	0	9	9	0	43	43
Annual Value of CVD Premature Mortality Cases Avoided due to Filters (millions of 2022 USD)	$0.0	$139.6	$139.6	$0.0	$631.9	$631.9
Total Annual Benefit of CVD Premature Mortality Cases Avoided (millions of 2022 USD)	**$1,750.7**	**$9,454.3**	**$7,703.6**	**$8,174.9**	**$25,210.0**	**$17,035.1**

Acronyms: CCT = corrosion control treatment; CVD = cardiovascular disease; LCRI = Lead and Copper Rule Improvements; SLR = lead service line replacement; POU = point-of-use; PWSs = public water systems; USD = United States dollar.

Exhibit 5-36: Estimated National Annual Benefits - 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual Child Cognitive Development Benefits	$1,208.5	$6,831.3	$5,622.8	$3,279.0	$10,963.0	$7,684.0
Annual Low-Birth Weight Benefits	$1.0	$5.4	$4.4	$1.8	$5.7	$3.9
Annual ADHD Benefits	$33.6	$196.3	$162.7	$179.9	$599.5	$419.6
Annual Adult CVD Premature Mortality Benefits	$1,750.7	$9,454.3	$7,703.6	$8,174.9	$25,210.0	$17,035.1
Total Annual Benefits	**$2,993.8**	**$16,487.3**	**$13,493.5**	**$11,635.6**	**$36,778.2**	**$25,142.6**

Acronyms: ADHD = Attention-Deficit/Hyperactivity Disorder; CVD = cardiovascular disease; LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

5.7 Uncertainty in the Quantified Benefits

The quantified benefits are based on four endpoints. There is uncertainty in the true magnitude of the benefits of lead reductions, as there are several health risks that are anticipated to be reduced by the rule, but were not quantified in this analysis, see Section 5.8, Appendix D, and the EPA's Lead ISA (2024a). This is the large uncertainty in the analysis and will result in an overall underestimation of benefits even given the other uncertainties discussed in this section.

It should also be noted that all the results displayed in through are national averages. The EPA expects that there will be individuals that are exposed to higher (or lower) water concentrations than represented by the mean estimates in the exhibits. These individuals will have greater (or lower) reductions in risk of adverse health effects, and thus higher (or lower) benefits due to the final rule for those endpoints quantified here and presented as population averages. Additional uncertainties as they relate to specific components of the benefits analysis are discussed below. General uncertainties are discussed in Sections 5.7.1-5.7.3 and endpoint specific uncertainties are discussed in more detail in Sections 5.7.4-5.7.7. Uncertainty in the underlying assumptions in SafeWater LCR and the estimated costs can be found in Chapter 4, Section 4.2.2. Limitations of the water concentration modeling were discussed in Section 5.2.5 and limitations in the assignment of the drinking water concentrations to the modeled population are discussed in Section 5.3. Additionally, these are briefly summarized in Exhibit 5-37.

Exhibit 5-37: Uncertainties in the Benefits Analysis

Issue	Addressed with High/Low Scenario?	Direction of Bias
Changing population demographics including fertility and immigration rates	No	Unclear
Uncertainty related to the estimation of baseline and policy scenario drinking water lead concentrations	No	Unclear
The presence and degree to which potential lead exposed individuals engage in averting behavior under the baseline and regulatory options.	No	Unclear
Effects of changes in CCT in the absence of LSL status changes	No	Underestimate
Effects of CCT in respect to water chemistry and corrosion control practices, lead sources other than service lines.	No	Unclear
Relative contribution of particulate lead	No	Underestimate
Number, type, and age of residences with LSLs	No	Unclear
Typical water concentrations and exposure patterns in multi-family residences, workplaces, schools, and other public places.	No	Unclear

Issue	Addressed with High/Low Scenario?	Direction of Bias
Typical exposure patterns based on water usage patterns in homes, service line length, and the length of pipes between service line and tap.	No	Unclear
The EPA assumes that the ages and number of people in households with LSLs are the same as the distribution in general population	No	Unclear
Estimates of the 90th percentile water concentrations, which trigger water systems to make changes due to AL exceedances (ALEs).	Yes	Unclear
The EPA does not quantify all health effects from lead exposure.	No	Underestimate
Both the SHEDS-PB and AALM models have been peer reviewed, however some uncertainty remains in the selected parameters and inputs. Assumptions around percentage of daily water for the home tap, water ingestion rates, and lead absorption through the gut will impact the modeled blood lead levels	No	Unclear
CVD premature mortality studies, LBW and ADHD studies use a single measurement of BLL.	No, discussed qualitatively	Unclear
The EPA assumes that filters result in the lowest drinking water concentration modeled. This assumes that everyone is properly and consistently using the filter. Including after a lead or GRR service line replacement when water lead concentrations may increase for a short period of time not captured in EPA's water lead concentration modeling.	No	Overestimate
The EPA assumes that both population and age distribution remain stable over the study period.	No	Unclear
Uncertainty in the shape of the concentration-response function for IQ, ADHD, LBW or CVD premature mortality.	Partially, except for LBW a high and low function are used.	Unclear
Uncertainty about the extent of the lag between changes in lead exposure and reductions in risk for CVD premature mortality and the fact that no cessation lag is used in the benefits modeling.	No	Overestimate (if there is a cessation lag see Section 5.7.7)
The EPA estimates avoided CVD premature mortality impacts for adults ages 40 through 79 only.	No	Underestimate
ADHD and LBW valuations do not capture willingness-to-pay to avoid the risk or any reductions in quality of life.	No	Underestimate
Valuation of avoided IQ point losses is not updated for future changes in real wage growth.	No	Unclear

Issue	Addressed with High/Low Scenario?	Direction of Bias
Other uncertainties		
Timing of CCT changes and LSL replacements	No	Unclear
Uncertainty if the system changes source water or treatment technology as a result of circumstances not related to the LCRI	No	Unclear

Acronyms: AALM = All Ages Lead Model; ADHD = Attention-Deficit/Hyperactivity Disorder; BLL = blood lead level; CCT = corrosion control treatment; CVD = cardiovascular disease; GRR = galvanized requiring replacement; IQ = intelligence quotient; LCRI = Lead and Copper Rule Improvements; LBW = low birth weight; LSL = lead service line.

5.7.1 Uncertainty in Blood Lead Modeling

For a discussion of the limitations in the drinking water concentration modeling, see Section 5.2.5. In order to model the expected blood lead changes due to reductions in drinking water lead exposures, the EPA used two models, both which have been peer reviewed. For children under seven, the EPA used the SHEDS-Pb model, and for older children and adults, the AALM. While there is both uncertainty and variability in the parameters and inputs to the models, both models have demonstrated that they predict blood levels well. See Zartarian (2017; 2023) and USEPA (2019b). Certain parameters, such as lead absorption through the gut and drinking water ingestion rate, as well as how much water is home tap water vs. other sources will have the greatest impact on the resulting modeled blood levels. However, in estimating the benefits, we are looking at the change between two modeled outputs, which will minimize the effects of uncertainty in these assumptions.

The EPA models blood lead levels based on the drinking water concentrations in Exhibit 5-12. The EPA assumes there is no difference in the geometric mean water lead concentration of systems with no LSL, regardless of the CCT status. In other words, for each of the three scenarios of no LSL – no CCT, no LSL – partial CCT, and no LSL – representative CCT, the geometric mean water lead concentration is equivalent. A sensitivity analysis for the 2021 LCRR (USEPA, 2020a) demonstrated that this will result in an underestimation of benefits, if it is assumed that there are additional water lead reductions with improved CCT in the absence of an LSL. This is discussed further in Section 5.8.

The lead concentration estimates for soil, air, and food are held constant in the blood lead modeling in order to represent background lead levels, with the only varying concentration being drinking water. It is likely that exposure, from soil, air, and food, and resulting BLLs will vary over time, and this uncertainty propagates across all modeled health benefits. Model simulations for adults also do not account for higher historical lead exposures and long-term bone accumulation that may have occurred prior to the baseline or regulatory scenarios. BLLs are reflective of both recent exposures (less than 30 days) and past exposures (years to decades) that were stored in tissues (e.g., bone) and released endogenously (Abt Associates, 2023; NTP, 2012).

5.7.2 General Uncertainty in Concentration-Response Relationships and Population

For all endpoints, there is uncertainty in the choice of studies from which to derive the concentration-response relationship, the best functional form to describe the relationship, and the best method to

characterize avoided heath risk at blood lead levels below those observed in the literature, as blood lead levels in the United States have declined over the years. For endpoint specific discussions, see Sections 5.7.4-5.7.7. For IQ, ADHD and CVD premature mortality, the EPA selected a low and high concentration-response function from the available literature to estimate of the benefits. For LBW, the EPA determined that there was only one available high-quality study, Zhu et al. (2010), therefore this was the only function used for this endpoint. The shape of the concentration-response function impacts the benefits estimates. For the same absolute change in BLLs (eg. 1 µg/dl), benefits will be smaller at higher BLLs when using a log or square root function as compared to a linear function.

There will also be uncertainty on the size of the population in the future which will experience benefits. However, while the fertility rate has decreased over time, there has been a simultaneous increase in the overall U.S. population, resulting in a fairly constant overall number of children in the U.S. For example, according to the American Community Survey[196], in 2000 there were 19,046,754 children under 5 (total population = 281 million), and in 2022 there were 19,004,925 children under 5 (total population = 331 million).

5.7.3 General Uncertainty in Valuation

If the EPA used a discount rate lower than 2 percent, it would generally result in an increase in the estimated dollar amount for benefits above those estimated using a 2 percent discount rate. This increase in benefits would result from both a higher baseline value of an IQ point, case of ADHD or CVD premature mortality and lower birth weight due to the decreased discounting of future benefits. Additionally, the use of the declining discount rate (see Section 5.5.2) when calculating the value of an IQ point and avoided ADHD case, done to comply with OMB Circular A-4 (OMB, 2023), results in slightly higher monetized IQ and ADHD benefits than if that assumption was not made[197]. Changes in valuation assumptions would not impact the overall risk reductions expected due to the rule.

For ADHD and LBW, the EPA uses a cost of illness approach. This approach was necessary as other values were not available for these endpoints, but this approach may underestimate benefits compared to other methods such as stated preference studies providing willingness-to-pay estimates (Woodruff, 2015, USEPA, 2010). Additionally, there is uncertainty in discounting benefits, particularly for children, which occur in the future (Woodruff, 2015). While ADHD may be associated with LBW, there is no double counting in the monetized benefits. The cost-of-illness for LBW only includes costs before age 2, and the ADHD cost-of-illness only includes costs after ADHD diagnosis, not in early childhood. The EPA's cost-of-illness estimate associated with LBW is an underestimate of the total impacts of low birth weight, as it only includes two years of medical costs and does not include parental productivity loss or other sequelae of low birth weight. Also, the valuation for ADHD may be underestimated because the Doshi et al (2012) estimates do not include productivity losses in adulthood related top ADHD after

[196] The U.S. Census Bureau's *American Community Survey* data is available at https://www.census.gov/programs-surveys/acs/data.html.

[197]The EPA used a declining discount rate which begins with a 2 percent discount rate for the years 2024-2079, a 1.9 percent discount rate used for the years 2080-2096, and a 1.8 percent discount rate used in years 2095-2102. This declining rate structure was implemented to comply with updates to OMB Circular A-4 guidance which indicates that a declining discount rate may be used to capture the uncertainty in the appropriate discount rate over long time horizons like lifetime labor force participation.

adjusting for IQ. Doshi et al. (2012) also does not include estimates of loss of employment or stress related illness.

5.7.4 Uncertainty in IQ

The relationship between lead and IQ is well documented (see USEPA, 2024a and Appendix D) and the approach used for the LCRI was reviewed by the SAB (USEPA, 2020b). The USEPA (2024a) ISA found sufficient evidence to conclude that there is a causal relationship between lead exposure and cognitive function decrements in children based on several lines of evidence including findings from prospective studies in diverse populations and coherence with evidence in animals, and evidence identifying potential modes of action. The NTP Monograph concluded that there is sufficient evidence of association between blood lead levels <5 µg/dL and decreases in various general and specific measures of cognitive function in children from 3 months to 16 years of age. This conclusion is based on prospective and cross-sectional studies using a wide range of tests to assess cognitive function (National Toxicology Program, 2012, p. 27).

However, there is still uncertainty in the approach to estimate IQ loss at lower blood lead levels, and the best approach to extrapolate beyond the observed range of blood leads in a given study. This includes uncertainty in the functional form of the dose response relationship and uncertainty in which study best describes the relationship (see Appendix D, Section D.7.1.2).

There is a detailed discussion of the methodology and limitations around the value of an IQ point in Appendix J of the Final 2021 LCRR EA and in USEPA (2019b). In addition, for this analysis, the EPA included an alternative valuation of an IQ point by Lin et al., (2018) as a sensitivity analysis presented in Appendix F. Briefly, uncertainties regarding the IQ-earnings relationship underlying the value of an IQ point include measurement error, lack of controls for non-cognitive skills that also affect test performance, and potential for bias due to other omitted variables likely to be correlated with both test performance and earnings, such as a supportive household or extra educational resources. Another uncertainty is to what extent estimated relationships from the published literature, which are based on historic data, will apply to future populations. Similarly, uncertainties may be introduced from applying average estimates based on a representative sample of the U.S. population to smaller subgroups that may be disproportionately affected by regulation.

Salkever (1995) explicitly modeled the role of education in the IQ-earnings relationship, which sheds light on the mechanism by which cognitive skills affect earnings and also allows the EPA to account for educational costs when calculating the change in net lifetime earnings from a change in IQ. The EPA reanalysis of Salkever (1995) relies on data where respondents range in age from 27 to 32. Extrapolating the Salkever (1995) IQ-earnings effect at age 30 will generate an estimate of lifetime earnings that is biased downward if the effect of IQ on earnings grows over the lifecycle, a result found in Barth et al. (1984), Zax and Rees (2002), Ganzach (2011), and Lin et al. (2018). An advantage of Lin et al. (2018) is the use of data that extends throughout the lifecycle up to age 50. However, their analysis lacked some control variables included in Salkever, and their inclusion of non-cognitive traits that are correlated with IQ and may be affected by lead exposure in the regression may attenuate the estimated effect of IQ on earnings, leading to a downward bias on the estimate of the total earnings effects of reduced lead exposure.

5.7.5 Uncertainty in ADHD

As described in Appendix D the USEPA (2024a) ISA strengthened the conclusions of the 2013 ISA and concluded that there was a *causal relationship* between lead exposure and inattention, impulsivity, and hyperactivity in children based on recent studies of children with group mean BLLs $\leq 5\ \mu g/dL$. The 2024 ISA states that "prospective studies of ADHD, including a study of clinical ADHD that controlled for parental education and SES, although not quality of parental caregiving reported positive associations" (USEPA, 2024a, p. IS-30). The causes of ADHD are not fully understood, but research suggests a number of potential causes, including genetics, exposure to environmental toxins, prenatal exposure to cigarette smoke or alcohol, and brain changes (Tripp et al., 2009; Pliszka et al., 2007). The EPA's 2013 lead ISA stated that in children, "attention was associated with biomarkers of Pb exposure representing several different lifestages and time periods. Prospective studies did not examine a detailed Pb biomarker history, and results do not identify an individual critical lifestage, time period, or duration of Pb exposure associated with attention decrements in children. Associations in prospective studies for attention decrements with tooth Pb level, early childhood average and lifetime average blood Pb levels point to an effect of cumulative Pb exposure." The 2024 ISA addresses the uncertainties presented in the 2013 ISA by stating that "The largest uncertainty addressed by the recent evidence base is the previous lack of prospective studies examining ADHD (Appendix 3.5.2.4–3.5.2.5). The bulk of the recent evidence comprises prospective studies that establish the temporality of the association between Pb exposure and parent or teacher ratings of ADHD symptoms and clinical ADHD. Across studies, associations were observed with tooth Pb concentrations, childhood BLLs (<6 µg/dL), and with maternal or cord BLLs (2–5 µg/dL)." The available studies relating blood lead to ADHD use one-time BLLs, while it is possible that cumulative exposure is also important. However, one-time and cumulative measures of BLLs in children are often correlated.

There are several sources of uncertainty in our choice of beta estimates for ADHD. In the 2001-2004 NHANES cycle, children without DSM-IV diagnostic data were younger, of lower SES, and more highly exposed to both Pb and environmental tobacco smoke than children with DSM-IV diagnostic data (Froehlich et al., 2009). This may have resulted in a downward bias of the effect size estimate. In Ji et al. (2018), the study population consisted mostly of a low-income, minority, urban population and is not representative of the entire US population. However, this population may be relevant as an at risk, potentially more highly exposed population for regulatory analyses of policies to reduce lead exposure.

An additional source of uncertainty in Froehlich et al. (2009) is the use of one-time, concurrent blood Pb measures to predict ADHD cases. However, the EPA ISA and NTP Monograph cite several prospective cohort studies that provide support for the association between Pb and ADHD symptoms, and Ji et al. (2018) is a prospective study that used early childhood (before age 4) Pb lead measures and found an association with ADHD measured later in childhood. In addition, the only study on reverse causation (David et al., 1977) identified in a literature search by Nigg et al. (2008) did not find any evidence for reverse causation in ADHD and Pb exposure. Instead, David et al. (1977) found that children with hyperactivity symptoms as a result of a known organic etiology had lower levels of Pb exposure than children with no known etiology.

It remains unclear whether concurrent blood Pb measure most accurately represents association between Pb and ADHD or if another blood Pb measure (e.g., lifetime average, early childhood) would be a better measure. There were no studies that use repeated measures which include early childhood and

concurrent measures. However, Froehlich et al. (2009) draw a parallel with studies of IQ, noting that concurrent blood Pb levels are strongly associated with decreases in cognitive function when compared with early childhood or peak blood Pb levels. Ji et al., (2018) also found that early childhood lead levels are associated with ADHD.

For a description of the uncertainties with the valuation used for ADHD which may result in an underestimation, see Section 5.7.3.

5.7.6 Uncertainty in Reductions in Birth Weight

Unlike the other health endpoints, only one dose response function was used for estimating the relationship between blood lead and reductions in birth weight. Zhu et al. (2010) was the strongest study identified, and this choice was supported by peer reviewers (Versar, 2015). A discussion of the limitations of the Zhu et al. (2010) study can be found in Abt Associates (2022b); however, these should not prohibit the use of the concentration-response function.

The 2024 Pb ISA expands on the findings of the 2013 Pb ISA, specifically regarding Pb exposure and effects on preterm birth and low birthweight; thus, the evidence was sufficient to conclude that there is "*likely to be a causal relationship* between Pb exposure and effects on pregnancy and birth outcomes" (USEPA, 2024a, pp. IS-51-52). The 2024 ISA also acknowledges the "uncertainties related to the specific biomarkers of exposure associated with pregnancy and birth outcomes, the critical window of exposure, and potential confounding by co-occurring metals" (USEPA, 2024a, pp. IS-52). It is possible that the timing of the prenatal Pb exposure is key, and that studies that are cross-sectional in nature do not detect an association because the critical exposure window that would result in decreased birth weight has passed when blood Pb measurements are taken at birth. This possibility is supported by the fact that the vast majority of identified cohort studies that measured blood Pb levels prior to birth found an inverse and statistically significant relationship with birth weight.

There are also uncertainties and limitations related to the valuation estimate for low birth weight, which are described in detail in Abt Associates (2022c) which was externally peer-reviewed (MDB, 2022). Overall, these will likely lead to an underestimation in the quantified benefits. The main source of underestimation is that not all costs are included, and that the MEPs data has been shown to underestimate costs by about 10% due to both underutilization of healthcare and respondents underreporting care. Additionally, Due to the use of the pregnancy detail file in the analysis there was a limited sample size (Abt Associates 2022c).

5.7.7 Uncertainty in Cardiovascular Disease Premature Mortality Benefits

Detailed discussions of the uncertainty and variability associated with quantified CVD premature mortality benefits are provided in Brown et al., (2020) and Abt Associates (2023).[198] This section briefly summarizes these uncertainties. First, there is uncertainty about the functional form which best describes the relationship between blood Pb and CVD premature mortality. In order to partially mitigate

[198] Note the Abt Associates (2023) methodology was externally peer review. See the MDB, Inc. (2019) "Selection of Concentration-Response Functions between Lead Exposure and Adverse Health Outcomes for Use in Benefits Analysis: Cardiovascular-Disease Related Mortality" peer review documentation at https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NCEE&dirEntryID=342855

this, the EPA chose a high and low function based on those identified. There is also uncertainty in the exposure window that is most relevant to the risk outcome. Brown et al., (2020) and Abt Associates (2023) hypothesize that four major conceptual models may explain the temporal relationship between blood Pb and CVD premature mortality:

Model 1. CVD premature mortality risk=*f*(one-time blood Pb).

Model 2. CVD premature mortality risk=*f*(average blood Pb over *x* years).

Model 3. CVD premature mortality risk=*f*(average blood Pb over *x* years)+latency.

Model 4. CVD premature mortality risk=*f*(peak blood Pb).

However, when considering the relationship between adult Pb exposure and CVD premature mortality, it is uncertain which conceptual model is best. No studies used repeated measures of the biomarkers in evaluating the connection between blood Pb and CVD premature mortality. This resulted in uncertainty because blood Pb is reflective of both recent exposures (less than 30 days) and past exposures (years to decades) that were stored in tissues (e.g., bone) and released endogenously (Abt Associates, 2023; NTP, 2012). Therefore, as the EPA ISA (2024a) points out, uncertainties remain with respect to the timing, frequency, and magnitude of Pb exposure that best correlate with CVD premature mortality risk.

Additionally, as described in Brown et al., (2022), given the consistent finding across the literature, it can be concluded that the one-time measurement from NHANES is a predictor of CVD premature mortality, either because Model 1 is true or because it is a proxy measure due to its correlation with average blood Pb models over time (e.g., Model 2). Currently, Model 1 is the only model for which requisite data are available given that there are no studies, or data sources such as NHANES, published to date evaluating multiple blood Pb measurements in the same individual in association with CVD premature mortality. Therefore, the result is interpreted as CVD premature mortality risk being a function of the one-time blood Pb measurement.

Finally, although there is a lag between the blood Pb sample and death due to CVD premature mortality, both the Cox proportional hazards model and the Poisson regression analysis assume that the hazard ratio will be the same regardless of the follow-up time frame. There is no cessation lag or latency assumed in the model. Therefore, the result is interpreted as CVD premature mortality risk being a function of the one-time blood Pb measurement. Incorporating a cessation lag would result in a decrease in monetary benefits, as the valuation of the avoided risk would occur in later years, and be more heavily discounted than in the current analysis.

In order to reduce the uncertainties associated with estimating the cardiovascular premature mortality effects of changes in adult lead exposure, studies using novel datasets or approaches will likely be required, such as recent bone lead measurements, repeated measurements of blood lead from the same individuals over time, or quasi-experimental variation in adult lead exposure linked to cardiovascular outcomes. If such studies become available in the future, EPA will consider updating the methodology for estimating the cardiovascular premature mortality effects of changes in adult lead exposure as appropriate.

5.8 Summary of Non-Quantified and Non-Monetized Benefits

In addition to the benefits monetized in the final LCRI analysis for reductions in lead exposure, there are several other benefits that are not quantified. The risk of adverse health effects due to lead exposure that are expected to decrease as a result of the final LCRI are summarized in Appendix D and are expected to affect both children and adults. The EPA focused its non-quantified impacts assessment on the endpoints identified using two comprehensive U.S. Government documents summarizing the literature on lead exposure health impacts. These documents are the EPA's Integrated Science Assessment for Lead (ISA) (USEPA, 2024a), and the U.S. Department of Health and Human Services' NTP Monograph on Health Effects of Low-Level Lead (NTP, 2012). Both sources present comprehensive reviews of the literature as of the time of publication on the risk of adverse health effects associated with lead exposure. The EPA summarized those endpoints to which either the EPA ISA or the NTP Monograph assigned one of the top two tiers of confidence in the relationship between lead exposure and the risk of adverse health effects. These endpoints include cardiovascular morbidity effects, renal effects, reproductive and developmental effects (apart from ADHD and low birth weight), immunological effects, neurological effects (apart from children's IQ), and cancer.

There are a number of final LCRI requirements that reduce lead exposure to both children and adults that the EPA could not quantify. The final rule will require additional lead public education requirements that target consumers directly, schools and child care facilities, health agencies, and people living in homes with lead and GRR service lines. Increased education will lead to additional averting behavior on the part of the exposed public, resulting in reductions in the negative impacts of lead. The rule will also require the development of service line inventories that include additional information on lead connectors and make the location of the lead content service lines publicly accessible. This will give potentially exposed consumers more information and will provide potential home buyers with this information as well. Homeowners may request LSL/GRR service line removal earlier than a water system might otherwise plan on replacing the line. The benefits of moving these lead and GRR service line removals forward in time are not quantified in the analysis of the final LCRI. Because of the lack of granularity in the lead tap water concentration data available to the EPA for the regulatory analysis, the benefits of small improvements in CCT to individuals residing in homes with lead content service lines, like those modeled under Distribution System and Site Assessment are not quantified.

The EPA also did not quantify the CCT benefits of reduced lead exposure from lead-containing plumbing components (not including from LSL/GRRs) to individuals who reside in both: 1) homes that have LSL/GRRs but also have other lead-containing plumbing components, and 2) those that do not have LSL/GRRs but do have lead-containing plumbing components.[199] The EPA has determined that the final LCRI requirements may result in reduced lead exposure to the occupants of both these types of buildings as a result of improved monitoring and additional actions to optimize CCT. In the analysis of the LCRI, the number of both LSL/GRR and non-LSL/GRR homes potentially affected by water systems increasing their corrosion control during the 35-year period of analysis is 5.2 million in the low scenario

[199] Although the EPA estimated an average lead concentration for the first 10 liters of drinking water to inform the water lead concentration estimates used to quantify benefits the EPA could not calculate the CCT benefits associated with lead containing plumbing components (apart from LSL/GRR service lines), because the EPA used a pooled estimate for all CCT conditions in residences with no LSL/GRR in place (See Section 5.2.3 for additional information).

and 9.1 million in the high scenario. Some of these households may have leaded plumbing materials apart from LSL/GRRs, including leaded brass fixtures and lead solder. These households could potentially see reductions in tap water lead concentrations.

Some researchers have pointed to the potential for CCT cobenefits associated with reduced corrosion, or material damage, to plumbing pipes, fittings, and fixture, and appliances that use water owned by both water systems and homeowners (Levin, 2023). The corrosion inhibitors used by systems that are required to install or re-optimize CCT as a result of the final LCRI are expected to result in additional benefits associated with the increased useful life of the plumbing components and appliances (e.g., water heaters), reduced maintenance costs, reduced treated water loss from the distribution system due to leaks, and reduced potential liability and damages from broken pipes in buildings that receive treated water from the system. The replacement of GRR service lines may also lead to reduced treated water loss from the distribution system due to leaks (AwwaRF and DVGW-Technologiezentrum Wasser, 1996). The EPA did not have sufficient information to estimate these impacts nationally for the final LCRI rule analysis.

Additionally, the risk of adverse health effects associated with copper that are expected to be reduced by the final LCRI are summarized in Appendix E. These risks include acute gastrointestinal symptoms, which are the most common adverse effect observed among adults and children. In sensitive groups, there may be reductions in chronic hepatic effects, particularly for those with rare conditions such as Wilson’s disease and children predisposed to genetic cirrhosis syndromes. These diseases disrupt copper homeostasis, leading to excessive accumulation that can be worsened by excessive copper ingestion (NRC, 2000).

5.9 Disbenefits from Greenhouse Gas Emissions

The EPA is committed to understanding and addressing climate change impacts in carrying out the agency's mission of protecting human health and the environment. While the EPA is not required by SDWA 1412(b)(3)(C) to consider climate disbenefits under the HRRCA the agency has estimated the potential climate disbenefits caused by increased greenhouse gas (GHG) emissions associated with the operation of CCT at drinking water treatment facilities and the use of construction and transport vehicles in the replacement of LSLs and GRR service lines. As explained in section VI.A of the preamble, this disbenefits analysis is presented solely for the purpose of complying with E.O. 12866.

This section is broken into three parts that discuss the steps the EPA took to estimate the climate disbenefits associated with the final LCRI:

- Sub-section 5.9.1 describes the estimation of the per unit energy consumed in the operation of CCT and SLR, and the per unit GHG emissions associated with the energy consumed.
- Sub-section 5.9.2 discusses the calculation of the total incremental emissions in the SafeWater LCR model.
- Sub-section 5.9.3 describes the social cost of GHG estimates used to monetize the climate disbenefits and presents the results of the EPA analysis.

5.9.1 Energy Consumption and Unit Greenhouse Gas Emissions

As part of the estimation of the climate disbenefits associated with the requirements of the final LCRI the EPA developed:

- Estimates of annual energy consumed to operate CCT by types of CCT (pH adjustment, orthophosphate addition, or both pH and orthophosphate use) and system size;
- Estimates of energy consumed during the replacement of a lead service line which includes the use of diesel medium/heavy-duty vehicles and backhoe excavation equipment; and
- Unit greenhouse gas emissions for both electricity and vehicle fuel consumption.

This section describes the steps the EPA used to collect the energy consumption information and unit emission information.

5.9.1.1 Energy Consumption Estimates

The first step in estimating the incremental annual greenhouse gas emissions for the final LCRI is to develop unit energy consumption estimates for operating CCT and conducting a service line replacement.

5.9.1.1.1 Electricity Consumption Operating CCT

The EPA estimated the electricity consumed by a system, in each system size category and by each type of CCT (pH adjustment, orthophosphate addition, or both pH and orthophosphate use), that would be required to operate CCT under the final LCRI. Estimates of electricity use have already been calculated as part of the CCT unit costing effort described in Chapter 4, Section 4.3.3. The EPA uses the electricity consumption values derived from its CCT Work Breakdown Structure (WBS) cost models, which are described in Section 4.2.2.3 and detailed in *Technologies and Costs for Corrosion Control to Reduce Lead in Drinking Water* (USEPA, 2023b). The estimated WBS O&M cost equations are a function of average daily flow (ADF) and include electricity consumption for the following:

- Increased building lighting requirements associated with the incremental operator labor required to operate the corrosion control processes.
- For large systems of 1 million gallons per day (MGD) or greater design flow, periodic operation of transfer pumps that move corrosion control chemicals between bulk storage tanks and day tanks.

The models assume that smaller systems (less than 1 MGD design flow) do not include transfer pumping because they feed chemicals directly from 55-gallon drums. The models assume electricity consumption by chemical metering pumps is negligible because these pumps require less than 1 horsepower to operate. There are no other sources of electricity consumption associated with the corrosion control processes.

As shown in Exhibit 5-38, the WBS model outputs are specific to the type of corrosion control technology and available for each of eight model system size categories. These outputs assume installation and operation of a new chemical addition process.

Exhibit 5-38: Corrosion Control Treatment Total Annual Electricity Consumption by System Size and Type of Chemical Addition

Technology and Population Served	Design Flow (MGD)	Average Flow (MGD)	Lighting Electricity Consumption (MWh/year)	Transfer Pump Electricity Consumption (MWh/year)	Total Electricity Consumption (MWh/year)
Centralized Orthophosphate Treatment (a)					
25 to 100	0.03	0.007	0.000861875	0	0.000861875
101 to 500	0.124	0.035	0.000861875	0	0.000861875
501 to 1,000	0.305	0.094	0.000861875	0	0.000861875
1,001 to 3,300	0.74	0.251	0.0010452	0	0.0010452
3,301 to 10,000	2.152	0.819	0.0014228	0.017011281	0.018434081
10,001 to 50,000	7.365	3.2	0.0022218	0.017011281	0.019233081
50,001 to 100,000	22.614	11.087	0.005738175	0.017011281	0.022749456
Greater than 100,000	75.072	37.536	0.011041875	0.017011281	0.028053156
Centralized pH Adjustment (b)					
25 to 100	0.03	0.007	0.000921875	0	0.000921875
101 to 500	0.124	0.035	0.000921875	0	0.000921875
501 to 1,000	0.305	0.094	0.000921875	0	0.000921875
1,001 to 3,300	0.74	0.251	0.0015188	0	0.0015188
3,301 to 10,000	2.152	0.819	0.0023658	0.017011281	0.019377081
10,001 to 50,000	7.365	3.2	0.0037458	0.017011281	0.020757081
50,001 to 100,000	22.614	11.087	0.010253075	0.017011281	0.027264356
Greater than 100,000	75.072	37.536	0.016692575	0.034022563	0.050715138
Both Centralized pH Adjustment and Orthophosphate Treatment (a, b)					
25 to 100	0.03	0.007	0.00178375	0	0.00178375
101 to 500	0.124	0.035	0.00178375	0	0.00178375
501 to 1,000	0.305	0.094	0.00178375	0	0.00178375
1,001 to 3,300	0.74	0.251	0.002564	0	0.002564
3,301 to 10,000	2.152	0.819	0.0037886	0.034022563	0.037811163
10,001 to 50,000	7.365	3.2	0.0059676	0.034022563	0.039990163
50,001 to 100,000	22.614	11.087	0.01599125	0.034022563	0.050013813
Greater than 100,000	75.072	37.536	0.02773445	0.051033844	0.078768294

Notes: (a) assumes phosphate addition of 3.2 milligrams per liter as phosphate; (b) assumes pH increase from 6.8 to 7.5. MGD = million gallons per day; MWh = megawatt hours

5.9.1.1.2 Service Line Replacement Fuel Consumption

The EPA used the following assumptions in the estimation of the fossil fuel energy consumed as part of an average service line replacement:

- Diesel medium/heavy duty trucks would be used to transport work supplies and backhoe to the SLR site. The assumption of a medium/heavy duty truck is necessary given the towing capacity needed to haul the backhoe to the SLR site.

- The weighted average round trip distance to each SLR site is estimated to be 12.32 miles. This value comes from the estimated driving distance per system size category as presented in Section 4.3.2.1.2, Exhibit 4-14, multiplied by two to approximate the round trip distance, and weighted by the estimated total number of lead (partial and full) and GRR service lines to be replaced in each size category as presented in Section 3.3.4.1.2, Exhibit 3-19[200]. Note that the EPA is assuming that each SLR requires an individual round trip from a central staging area and that there is no grouping as would likely occur in the case of planned scheduled SLRs, therefore, the estimated emissions from SLR are likely overestimated.
- Backhoes would operate on site for one hour consuming two gallons of diesel. The two gallon per hour value is the central estimate from a 1.5 to 2.5 range provided by the website: https://cpower.com/2021/11/16/types-of-gas-for-your-rental-construction-vehicle/.

5.9.1.2 Converting Consumed Energy Estimates into Greenhouse Gas Emissions

As a second step, the EPA developed estimates of greenhouse gas emissions associated with the electricity used to operate CCT and the fossil fuels used in the replacement of service lines.

5.9.1.2.1 Electricity Emissions

To convert the estimated increase in electricity use associated with the annual operation of CCT into greenhouse gas emissions per system, the EPA used the latest reference case from the EPA's peer-reviewed Integrated Planning Model (IPM) (USEPA, 2023d).[201] The EPA uses the IPM to analyze the projected impact of environmental policies on the electric power sector, and it also provides projections of CO_2 emissions from the power sector through 2055. The latest reference case, "Post-IRA 2022 reference case" was published in April of 2023 and reflects the impacts of the Inflation Reduction Act (IRA).

Although the U.S. electricity grid continues to decrease its reliance on coal combustion in favor of natural gas and renewable alternatives, electricity consumption continues to be associated with GHG emissions across the entire system of production and delivery. Combustion of fossil fuels releases CO_2, CH_4, and N_2O; sulfur hexafluoride (SF_6) and perfluorocarbons (PFCs) are used in electricity transmission and distribution equipment; and additional GHG emissions are associated with the manufacture and installation of equipment as well the extraction and delivery of fossil fuels (USEPA, 2023c). An exact accounting of all these emissions categories would yield the most precise estimate of electricity sector climate-related impacts. However, emissions from fossil fuel combustion comprise the vast majority of the electricity sector GHG emissions, 90 to 97 percent. Therefore, accounting for GHG combustion emissions is sufficient for the purposes of estimating the approximate magnitude of the climate-related

[200] For detailed calculations, see the derivation file "Service Line Characterization using DWINSA_Final.xlsx," worksheet "Mileage Weighted by SLs Replace," available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

[201] The IPM is a multi-regional, dynamic, deterministic linear programming model of the U.S. electric power sector. It provides projections of least-cost capacity expansion, electricity dispatch, and emission control strategies for meeting energy demand and environmental, transmission, dispatch, and reliability constraints (USEPA,).

disbenefits of increased electricity consumption associated with the LCRI requirements.[202] Note that the non-GHG emissions impacts associated with changes in electricity consumption are not accounted for in this analysis. For a more complete description of non-GHG impacts from the electricity sector, including ozone- and PM2.5-attributable premature mortality and illness as well as discussion of various unquantified health and welfare impacts, see recent EPA regulatory impact analyses for air pollution regulations and the utilities sector in particular (USEPA, 2023e).

From IPM reference case summary outputs, the EPA calculated projections of annual national-average emissions per MWh of electricity generation over the LCRI period of analysis. The EPA mapped IPM model CO_2 data to calendar years, corresponding to the 35 years in the LCRI period of analysis, following the IPM documentation guidance (USEPA, 2023f).[203] Exhibit 5-39 shows the IPM summary outputs and implied national-average CO_2 emissions factors for each IPM model year. The EPA also used information from USEPA (2021) to estimate the amount of CH_4 and N_2O produced for each unit of CO_2 produced per unit of electricity. The EPA used these values to estimate CH_4 and N_2O produced per MWh/year.

Exhibit 5-39: Emissions per MWh Calculated from Post-IRA 2022 IPM Reference Case

IPM Model Year	CO_2 Emissions (Million Metric Tons/year)[a]	Grand Total Electricity Generated (Billions MWh/year)[a]	CO_2 Emissions (mt/MWh/year)	CH4 Emissions (mt/MWh/year)[b]	N2O Emissions (mt/MWh/year)[b]
2028	1,222	4.409	0.277	0.104	0.015
2030	672	4.545	0.148	0.057	0.008
2035	608	4.891	0.124	0.052	0.008
2040	481	5.265	0.091	0.041	0.006
2045	406	5.628	0.072	0.034	0.005
2050	357	6.071	0.059	0.030	0.004
2055	391	6.454	0.061	0.033	0.005

[a]**Source**: Post IRA Reference Case SSR.xlsx available at: https://www.epa.gov/power-sector-modeling/post-ira-2022-reference-case.

[b]In order to estimate the CH_4 and N_2O produced per MWh per year the EPA used data from USEPA, 2021 to estimate the amount of CH_4 and N_2O produced for each unit of CO_2 produced.

5.9.1.2.2 Fuel Emissions

In order to develop the estimated emissions that result from lead and GRR service line replacement the EPA utilized the emissions factors found in its 2021 publication *Emission Factors for Greenhouse Gas*

[202] See the EPA's Economic Analysis for the Final Per- and Polyfluoroalkyl Substances National Primary Drinking Water Regulation (USEPA, 2024d) for additional discussion on the relative percent of fossil fuel combustion to other sources of GHG in the electricity sector.

[203]The EPA mapped the calendar years 2027 and 2028 to IPM run year 2028, calendar years 2029-31 to IPM run year 2030, calendar years 2032-37 to IPM run year 2035, calendar years 2038-42 to IPM run year 2040, calendar years 2043-47 to IPM run year 2045, calendar years 2048-52 to IPM run year 2050, and calendar years 2053-58 to IPM run year 2055.

Inventories (USEPA, 2021). The CO_2, CH_4, and N_2O emission values per mile for medium/heavy duty trucks and per gallon for backhoes are presented in Exhibit 5-40.

Exhibit 5-40: Greenhouse Gas Emission Values Per Mile or Gallon of Fuel

Assumption	Value	Source and Notes
Medium/Heavy Duty Truck kg CO_2 per vehicle mile	1.407	USEPA, 2021, Table 8. Vehicle-mile factors are appropriate to use when the entire vehicle is dedicated to transporting the reporting company's product.
Medium/Heavy Duty Truck kg CH_4 per vehicle mile	0.000013	USEPA, 2021, Table 8, converted from g/vehicle-mile. Vehicle-mile factors are appropriate to use when the entire vehicle is dedicated to transporting the reporting company's product.
Medium/Heavy Duty Truck kg N_2O per vehicle mile	0.000033	USEPA, 2021, Table 8, converted from g/vehicle-mile. Vehicle-mile factors are appropriate to use when the entire vehicle is dedicated to transporting the reporting company's product.
Backhoe kg CO_2 per gallon	10.21	USEPA, 2021, Table 2
Backhoe kg CH_4 per gallon	0.0002	USEPA, 2021, Table 4 for construction/mining equipment, converted from g/gallon
Backhoe kg N_2O per gallon	0.00047	USEPA, 2021, Table 4 for construction/mining equipment, converted from g/gallon

Source: USEPA. 2021. *Emission Factors for Greenhouse Gas Inventories*. Retrieved from epa.gov/sites/default/files/2021-04/documents/emission-factors_apr2021.pdf

5.9.2 Calculating Annual Total Incremental Emissions in SafeWater LCR

The EPA tracks and compiles the GHG emissions for both CCT and SLR in the SafeWater LCR model as step three in the estimation of climate disbenefits. The SafeWater LCR model applies a unit emission value each time an activity (CCT installation, and LSL/GRR service line replacement) is triggered in the model.

In the case of CCT see Chapter 3, Section 3.3.5.1 for a discussion of the estimated percent of systems both in the baseline 2021 LCRR and the final rule that will exceed the action levels from both rules (0.015 mg/L for 2021 LCRR and 0.010 mg/L for the final LCRI) and must install new CCT. Also see Chapter 4, Section 4.4.3, which provides estimates for the type of CCT to be install or re-optimized be it pH, orthophosphate, or both pH and orthophosphate. Note that the emissions tracked by the model are associated with the annual energy consumed to operate CCT, therefore, like CCT O&M costs, the EPA applies the emission value in the year in which CCT is installed and in each year after until the end of the period of analysis. Exhibit 5-41 provides the estimated annual per CCT installation CO_2, CH_4, and N_2O emission values.

Exhibit 5-41: Estimated Emissions per CCT Installation

Technology and Population Served	Total Electricity Consumption (MWh/year)	CO_2 Emissions (mt/MWh/year)	CH_4 Emissions (mt/MWh/year)	N_2O Emissions (mt/MWh/year)
Centralized Orthophosphate Treatment (a)				
25 to 100	0.000861875	2.39E-04	2.02557E-08	2.97282E-09
101 to 500	0.000861875	2.39E-04	2.02557E-08	2.97282E-09
501 to 1,000	0.000861875	2.39E-04	2.02557E-08	2.97282E-09
1,001 to 3,300	0.0010452	2.90E-04	2.45642E-08	3.60516E-09
3,301 to 10,000	0.018434081	5.11E-03	4.33236E-07	6.35838E-08
10,001 to 50,000	0.019233081	5.33E-03	4.52014E-07	6.63397E-08
50,001 to 100,000	0.022749456	6.31E-03	5.34656E-07	7.84686E-08
Greater than 100,000	0.028053156	7.78E-03	6.59303E-07	9.67624E-08
Centralized pH Adjustment (b)				
25 to 100	0.000921875	2.56E-04	2.16658E-08	3.17978E-09
101 to 500	0.000921875	2.56E-04	2.16658E-08	3.17978E-09
501 to 1,000	0.000921875	2.56E-04	2.16658E-08	3.17978E-09
1,001 to 3,300	0.0015188	4.21E-04	3.56947E-08	5.23872E-09
3,301 to 10,000	0.019377081	5.37E-03	4.55398E-07	6.68364E-08
10,001 to 50,000	0.020757081	5.75E-03	4.87831E-07	7.15964E-08
50,001 to 100,000	0.027264356	7.56E-03	6.40764E-07	9.40416E-08
Greater than 100,000	0.050715138	1.41E-02	1.1919E-06	1.74929E-07
Both Centralized pH Adjustment and Orthophosphate Treatment (a, b)				
25 to 100	0.00178375	4.95E-04	4.19215E-08	6.1526E-09
101 to 500	0.00178375	4.95E-04	4.19215E-08	6.1526E-09
501 to 1,000	0.00178375	4.95E-04	4.19215E-08	6.1526E-09
1,001 to 3,300	0.002564	7.11E-04	6.02589E-08	8.84388E-09
3,301 to 10,000	0.037811163	1.05E-02	8.88634E-07	1.3042E-07
10,001 to 50,000	0.039990163	1.11E-02	9.39845E-07	1.37936E-07
50,001 to 100,000	0.050013813	1.39E-02	1.17542E-06	1.7251E-07
Greater than 100,000	0.078768294	2.18E-02	1.85121E-06	2.71692E-07

Notes: (a) assumes phosphate addition of 3.2 milligrams per liter as phosphate; (b) assumes pH increase from 6.8 to 7.5. MGD = million gallons per day; MWh = megawatt hours

The SafeWater LCR model also applies a unit emission value per LSL/GRR service line replacement in each period when a replacement occurs. This value is the sum of both the per mile emissions for transportation to the replacement location using a medium/heavy duty vehicle and the per gallon emissions for the use of a backhoe for onsite excavation. See Chapter 3, Section 3.3.4 for the estimated number of lead and GRR service lines in the baseline, and see Chapter 1, Section 1.1 for the 2021 LCRR and final LCRI replacement requirements. Exhibit 5-42 shows the per service line replacement CO_2, CH_4, N_2O total emissions.

Exhibit 5-42: Estimated Emissions Per Service Line Replacement

Type of Greenhouse Gas	Medium/heavy Duty Vehicle Emissions (kg/SLR)	Backhoe Emissions (kg/SLR)	Total Emissions (kg/SLR)
CO_2	16.41969	20.42	36.83969
CH_4	0.00015171	0.0004	0.00055171
N_2O	0.00038511	0.00094	0.00132511

As indicated in Chapter 4, Exhibit 4-134, the SafeWater LCR model estimated that over the 35-year period of analysis the final LCRI results in an incremental increase in lead and GRR service line replacement of between 6,392,911 and 6,109,511 under the low and high scenarios, respectively. Incremental installation of CCT is projected to occur at 3,089 systems under the low scenario and 3,994 systems under the high scenario. Exhibit 5-43 shows the estimated total incremental GHG emissions by year for the final LCRI. As indicated in the exhibit, the primary source of GHG emissions is associated with SLR as indicated by the relatively high emissions in the years 4 through 13. Also note that for a number of years at the beginning and end of the period of analysis, projected 2021 LCRR GHG emissions are higher than final LCRI emissions, resulting in negative incremental GHG emissions for the final LCRI in those periods. Total incremental emissions over 35 years are positive for the final LCRI with ranges of 241,504 to 230,669 metric tons of CO_2, 9 to 8 metric tons of CH_4, and 4 to 3 metric tons of N_2O, between the low and high scenarios.

Exhibit 5-43: Estimated Total Annual Incremental Greenhouse Gas Emissions for Final LCRI

SafeWater Model Period	Calander Year	Low Scenario			High Scenario		
		Emission Changes (metric tons)			Emission Changes (metric tons)		
		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
1	2024	(1593.002)	(0.057)	(0.024)	(2857.419)	(0.102)	(0.042)
2	2025	(1591.932)	(0.057)	(0.024)	(2874.874)	(0.103)	(0.043)
3	2026	(1588.819)	(0.057)	(0.024)	(2901.083)	(0.104)	(0.043)
4	2027	23679.172	0.847	0.351	22433.824	0.802	0.333
5	2028	23675.548	0.846	0.351	22434.117	0.800	0.333
6	2029	24290.219	0.868	0.360	23126.776	0.825	0.343
7	2030	24874.708	0.889	0.369	24702.458	0.881	0.367
8	2031	24867.434	0.890	0.369	24715.734	0.885	0.367
9	2032	24721.220	0.884	0.367	24532.075	0.878	0.364
10	2033	24713.680	0.884	0.367	24528.046	0.878	0.364
11	2034	24703.196	0.884	0.366	24527.649	0.878	0.364
12	2035	24705.405	0.884	0.366	24547.124	0.878	0.364
13	2036	24715.450	0.884	0.367	24539.064	0.878	0.364
14	2037	750.996	0.027	0.011	650.899	0.024	0.010

SafeWater Model Period	Calander Year	Low Scenario			High Scenario		
		Emission Changes (metric tons)			Emission Changes (metric tons)		
		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
15	2038	731.454	0.027	0.011	614.957	0.022	0.009
16	2039	745.727	0.027	0.011	647.835	0.024	0.010
17	2040	758.176	0.028	0.011	659.921	0.024	0.010
18	2041	752.179	0.027	0.011	664.430	0.024	0.010
19	2042	756.668	0.027	0.011	659.966	0.024	0.010
20	2043	760.771	0.027	0.011	670.945	0.024	0.010
21	2044	59.186	0.002	0.001	(32.525)	(0.001)	(0.001)
22	2045	(16.962)	(0.000)	(0.000)	(104.318)	(0.003)	(0.002)
23	2046	(303.706)	(0.011)	(0.005)	(402.862)	(0.014)	(0.006)
24	2047	(307.444)	(0.011)	(0.005)	(407.982)	(0.014)	(0.006)
25	2048	(301.742)	(0.011)	(0.004)	(409.150)	(0.014)	(0.006)
26	2049	(301.891)	(0.011)	(0.004)	(410.415)	(0.014)	(0.006)
27	2050	(305.466)	(0.011)	(0.005)	(416.248)	(0.015)	(0.006)
28	2051	(303.461)	(0.011)	(0.005)	(422.171)	(0.015)	(0.006)
29	2052	(312.687)	(0.011)	(0.005)	(423.160)	(0.015)	(0.006)
30	2053	(305.008)	(0.011)	(0.005)	(405.398)	(0.014)	(0.006)
31	2054	(307.399)	(0.011)	(0.005)	(397.235)	(0.014)	(0.006)
32	2055	(307.624)	(0.011)	(0.005)	(386.657)	(0.014)	(0.006)
33	2056	(304.927)	(0.011)	(0.005)	(380.137)	(0.013)	(0.006)
34	2057	(300.724)	(0.011)	(0.004)	(380.607)	(0.013)	(0.006)
35	2058	(304.884)	(0.011)	(0.005)	(374.672)	(0.013)	(0.006)
Total Over 35 Years		241,503.509	8.643	3.582	230,668.909	8.253	3.421

5.9.3 Valuation of GHG Emissions

To monetize the climate disbenefits of the final LCRI, the EPA takes the estimated incremental annual emissions from Exhibit 5-43and applies the EPA's Social Cost of Greenhouse Gas values for all three tracked gases, CO_2, CH_4, and N_2O.

The SC-GHG is the monetary value of the net harm to society from emitting a metric ton of GHGs into the atmosphere in a given year, or the benefit of avoiding that increase. In principle, SC-GHG is a comprehensive metric that includes the value of all future climate change impacts (both negative and positive), including changes in net agricultural productivity, human health effects, property damage from increased flood risk, changes in the frequency and severity of natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services. The SC-GHG, therefore, reflects the societal value of reducing GHG emissions by one metric ton and is the theoretically appropriate value to use in conducting benefit-cost analyses of policies that affect GHG emissions. In practice, data and modeling limitations restrain the ability of SC-GHG estimates to include all physical, ecological, and economic impacts of climate change, implicitly assigning a value of zero to

the omitted climate damages. The estimates are, therefore, a partial accounting of climate change impacts and likely underestimate the marginal benefits of abatement (and marginal damages from emissions).

Since 2008, the EPA has used estimates of the social cost of various greenhouse gases (i.e., social cost of carbon (SC-CO2), social cost of methane (SC-CH4), and social cost of nitrous oxide (SC-N2O)), collectively referred to as the “social cost of greenhouse gases” (SC-GHG), in analyses of actions that affect GHG emissions. The values used by the EPA from 2009 to 2016, and since 2021 have been consistent with those developed and recommended by the Interagency Working Group (IWG) on the SC-GHG; and the values used from 2017 to 2020 were consistent with those required by E.O. 13783, which disbanded the IWG. During 2015–2017, the National Academies conducted a comprehensive review of the SC-CO2 and issued a final report in 2017 recommending specific criteria for future updates to the SC-CO2 estimates (which are also applicable to SC-CH4 and SC-N2O), a modeling framework to satisfy the specified criteria, and both near-term updates and longer-term research needs pertaining to various components of the estimation process (National Academies, 2017). The IWG was reconstituted in 2021 and E.O. 13990 directed it to develop a comprehensive update of its SC-GHG estimates, recommendations regarding areas of decision-making to which SC-GHG should be applied, and a standardized review and updating process to ensure that the recommended estimates continue to be based on the best available economics and science going forward.

The EPA is a member of the IWG and is participating in the IWG’s work under E.O. 13990. While that process continues, as noted in previous EPA RIAs, the EPA is continuously reviewing developments in the scientific literature on the SC-GHG, including more robust methodologies for estimating damages from emissions, and looking for opportunities to further improve SC-GHG estimation going forward. In the December 2022 RIA for the Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review, the agency included a sensitivity analysis of the climate benefits of the Supplemental Proposal using a new set of SC-GHG estimates that incorporates recent research addressing recommendations of the National Academies (2017) in addition to using the interim SC-GHG estimates presented in the Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990 (IWG, 2021) that the IWG recommended for use until updated estimates that address the National Academies’ recommendations are available.

The EPA solicited public comment on the sensitivity analysis and the accompanying draft technical report, EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances, which explains the methodology underlying the new set of estimates, in the December 2022 Supplemental Proposal (USEPA, 2023h). The public comments and the response to comments document can be found in the docket for the Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review.[204]

To ensure that the methodological updates adopted in the technical report are consistent with economic theory and reflect the latest science, the EPA also initiated an external peer review panel to conduct a high-quality review of the technical report, completed in May 2023. The peer reviewers commended the agency on its development of the draft update, calling it a much needed improvement

[204] https://www.regulations.gov/document/EPA-HQ-OAR-2021-0317-4009

in estimating the SC-GHG and a significant step towards addressing the National Academies' recommendations with defensible modeling choices based on current science. The peer reviewers provided numerous recommendations for refining the presentation and for future modeling improvements, especially with respect to climate change impacts and associated damages that are not currently included in the analysis. Additional discussion of omitted impacts and other updates have been incorporated in the technical report to address peer reviewer recommendations. Complete information about the external peer review, including the peer reviewer selection process, the final report with individual recommendations from peer reviewers, and the EPA's response to each recommendation is available on the EPA's website.[205]

For an overview of the methodological updates incorporated into the SC-GHG estimates applied in the EA for the final LCRI, see Section 3.2 of the RIA for the Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review (USEPA, 2023g). A more detailed explanation of each input and the modeling process is provided in the technical report, Supplementary Material for the RIA: EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances (USEPA, 2023h), included in the docket for the Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review, and included in the docket for this action.

Exhibit 5-44 summarizes the resulting averaged certainty-equivalent SC-GHG estimates under each near-term Ramsey discount rate that are used to estimate the climate disbenefits of the changes in GHG emissions expected to result from the final rule. These estimates are reported in 2022 dollars but are otherwise identical to those presented in USEPA (2023h). The SC-GHG values increase over time within the models — i.e., the societal harm from one metric ton emitted in 2030 is higher than the harm caused by one metric ton emitted in 2025 — because future emissions produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change, and because GDP is growing over time and many damage categories are modeled as proportional to GDP. The full results generated from the updated methodology for emissions years 2020 through 2080 are provided in US EPA (2023h).

Exhibit 5-44: Estimates of the Social Cost of CO2, CH4, and N2O, 2024-2058 (in 2022 USD)

Gas	CO_2	CO_2	CO_2	CH_4	CH_4	CH_4	N_2O	N_2O	N_2O
Near-term Ramsey Discount Rate	**2.50%**	**2.00%**	**1.50%**	**2.50%**	**2.00%**	**1.50%**	**2.50%**	**2.00%**	**1.50%**
2024	143	233	399	1,706	2,183	2,967	43,687	66,096	104,812
2025	146	237	403	1,780	2,267	3,064	44,748	67,468	106,587
2026	149	241	409	1,855	2,352	3,160	45,810	68,840	108,362

[205] https://www.epa.gov/environmental-economics/scghg-tsd-peer-review

Gas	CO_2	CO_2	CO_2	CH_4	CH_4	CH_4	N_2O	N_2O	N_2O
Near-term Ramsey Discount Rate	**2.50%**	**2.00%**	**1.50%**	**2.50%**	**2.00%**	**1.50%**	**2.50%**	**2.00%**	**1.50%**
2027	152	245	414	1,930	2,436	3,258	46,871	70,212	110,137
2028	156	250	420	2,005	2,521	3,354	47,932	71,585	111,911
2029	158	253	425	2,079	2,605	3,451	48,993	72,956	113,686
2030	161	257	430	2,154	2,690	3,548	50,055	74,329	115,461
2031	165	262	435	2,241	2,788	3,661	51,153	75,728	117,241
2032	168	265	441	2,329	2,886	3,774	52,251	77,127	119,020
2033	171	270	446	2,415	2,985	3,886	53,349	78,527	120,800
2034	174	274	451	2,502	3,083	3,999	54,448	79,925	122,579
2035	177	278	457	2,589	3,182	4,112	55,546	81,324	124,359
2036	180	282	461	2,677	3,279	4,225	56,644	82,724	126,137
2037	184	287	467	2,763	3,378	4,338	57,741	84,123	127,917
2038	187	290	472	2,850	3,476	4,450	58,839	85,522	129,696
2039	190	294	477	2,938	3,575	4,563	59,938	86,922	131,476
2040	194	299	483	3,025	3,672	4,676	61,036	88,321	133,255
2041	197	303	488	3,119	3,778	4,797	62,279	89,900	135,244
2042	200	308	494	3,214	3,886	4,919	63,524	91,478	137,234
2043	204	312	499	3,308	3,992	5,040	64,768	93,057	139,222
2044	208	317	505	3,403	4,098	5,161	66,012	94,636	141,211
2045	212	321	510	3,497	4,205	5,282	67,257	96,215	143,201
2046	215	326	517	3,592	4,311	5,404	68,500	97,793	145,190
2047	218	331	523	3,686	4,418	5,525	69,745	99,372	147,178
2048	223	336	528	3,782	4,524	5,646	70,989	100,951	149,168
2049	226	340	534	3,876	4,630	5,766	72,233	102,530	151,157
2050	229	345	540	3,971	4,737	5,889	73,478	104,108	153,145
2051	233	349	545	4,057	4,836	6,004	74,640	105,589	155,026
2052	236	353	550	4,143	4,936	6,119	75,803	107,070	156,906
2053	240	357	555	4,231	5,034	6,234	76,965	108,551	158,786
2054	243	362	560	4,317	5,134	6,350	78,128	110,032	160,666

Gas	CO_2	CO_2	CO_2	CH_4	CH_4	CH_4	N_2O	N_2O	N_2O
Near-term Ramsey Discount Rate	**2.50%**	**2.00%**	**1.50%**	**2.50%**	**2.00%**	**1.50%**	**2.50%**	**2.00%**	**1.50%**
2055	246	365	565	4,403	5,234	6,464	79,290	111,515	162,546
2056	249	369	571	4,490	5,332	6,579	80,453	112,996	164,426
2057	252	374	575	4,576	5,432	6,695	81,615	114,477	166,306
2058	255	378	581	4,663	5,531	6,810	82,778	115,958	168,187

Data from: EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances (https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf).
Note: The EPA used the GDP Price Deflator to adjust the 2020 Social Cost of GHG number provided in the report to 2022 dollars.

The methodological updates described in USEPA (2023h) represent a major step forward in bringing SC-GHG estimation closer to the frontier of climate science and economics and address many of the National Academies' (2017) near-term recommendations. Nevertheless, the resulting SC-GHG estimates, including the SC-CO2 estimates presented in Exhibit 5-44, still have several limitations, as would be expected for any modeling exercise that covers such a broad scope of scientific and economic issues across a complex global landscape. There are still many categories of climate impacts and associated damages that are only partially or not reflected yet in these estimates and sources of uncertainty that have not been fully characterized due to data and modeling limitations. Please see Section 3.2 of USEPA (2023h) for further discussion.

Exhibit 5-45 and Exhibit 5-46 present the monetized climate disbenefits from the GHG emissions associated with both the operation of CCT and SLR under the final LCRI low and high scenarios. The EPA multiplied the projected CO_2, CH_4, and N_2O emissions each year (shown in Exhibit 5-43) by the social cost of CO_2, CH_4, and N_2O estimates for that year (from Exhibit 5-44) and annualized these results over the 35-year period of analysis.[206] Monetized climate effects are presented under a 1.5 percent, 2 percent, and 2.5 percent near-term Ramsey discount rate, consistent with the EPA's updated SC-GHG estimates.[207] The EPA estimates climate disbenefits associated with this rule ranging from $3.3 million

[206] Consistent with the approach taken in EPA regulatory analyses from 2009 through 2016 and since 2021, the SC-GHG estimates used in this analysis reflect a global measure of climate damages from GHG emissions. As discussed at length in USEPA (2023h), because of the distinctive global nature of climate change in which GHG emissions contribute to damages around the world regardless of where they are emitted, the assessment of global net damages of GHG emissions allows the EPA to fully disclose and contextualize the net climate disbenefits of GHG emission increases expected from this final rule. Some modeling frameworks can also provide a partial characterization of U.S.-specific damages. For example, the Framework for Evaluating Damages and Impacts (FrEDI) model reflects the availability of U.S.-specific data and research on climate change effects (Hartin et al. 2023, EPA 2021). Applying U.S.-specific partial SC-GHG estimates derived from FrEDI to the GHG emission increases expected under the final rule would yield an annualized value of climate disbenefits of $8 to $8.4 million per year (under a 2 percent near-term Ramsey discount rate).
[207] As described in USEPA (2023h), the SC-GHG estimates rely on a dynamic discounting approach that provides internal consistency within the modeling and a more complete accounting of uncertainty consistent with economic

dollars per year under the LCRI low scenario (under a 1.5 percent near-term Ramsey discount rate) to $1.3 million dollars per year under the LCRI high scenario (under a 2.5 percent near-term Ramsey discount rate).

Exhibit 5-45: Climate Disbenefits of the Final LCRI Low Scenario (millions of 2022 USD)

	Near-term Ramsey Discount Rate		
	2.5%	2%	1.5%
Present and Annualized Values of CO2 Emission Changes (millions, 2022$)			
Present Value in 2022 (2022$)	31.70	52.72	91.81
Annualized Value (35 Years, 2022$)	1.37	2.11	3.39
Present and Annualized Values of CH4 Emission Changes (millions, 2022$)			
Present Value in 2022 (2022$)	0.02	0.02	0.03
Annualized Value (35 Years, 2022$)	0.00	0.00	0.00
Present and Annualized Values of N2O Emission Changes (millions, 2022$)			
Present Value in 2022 (2022$)	0.15	0.23	0.37
Annualized Value (35 Years, 2022$)	0.01	0.01	0.01
Total Present and Annualized Values of all GHG Emission Changes (CO2, CH4, and N2O) (millions, 2022$)			
Present Value in 2022 (2022$)	31.86	52.96	92.20
Annualized Value (35 Years, 2022$)	1.38	2.12	3.41

Exhibit 5-46: Climate Disbenefits of the Final LCRI High Scenario (millions of 2022 USD)

	Near-term Ramsey Discount Rate		
	2.5%	2.0%	1.5%
Present and Annualized Values of CO2 Emission Changes (millions, 2022$)			
Present Value in 2022 (2022$)	30.28	50.36	87.70
Annualized Value (35 Years, 2022$)	1.31	2.01	3.24
Present and Annualized Values of CH4 Emission Changes (millions, 2022$)			
Present Value in 2022 (2022$)	0.01	0.02	0.03
Annualized Value (35 Years, 2022$)	0.00	0.00	0.00
Present and Annualized Values of N2O Emission Changes (millions, 2022$)			
Present Value in 2022 (2022$)	0.14	0.22	0.35
Annualized Value (35 Years, 2022$)	0.01	0.01	0.01
Total Present and Annualized Values of all GHG Emission Changes (CO2, CH4, and N2O) (millions, 2022$)			
Present Value in 2022 (2022$)	30.44	50.60	88.08

theory and the National Academies' (2017) recommendation to employ a more structural, Ramsey-like approach to discounting that explicitly recognizes the relationship between economic growth and discounting uncertainty. This approach is also consistent with the National Academies' (2017) recommendation to use three sets of Ramsey parameters that reflect a range of near-term certainty-equivalent discount rates and are consistent with theory and empirical evidence on consumption rate uncertainty. See USEPA (2023h) for a more detailed discussion of the entire discounting module and methodology used to value risk aversion in the SC-GHG estimates.

Annualized Value (35 Years, 2022$)	1.32	2.02	3.25

Exhibit 5-45 and Exhibit 5-46 also show that estimated annualized climate disbenefits range from $2.1 million under the LCRI low scenario to $2.0 million under the LCRI high scenario when discounted at a 2 percent near-term Ramsey discount rate, in 2022 dollars. These disbenefits constitute less than 0.02-0.01 percent of the monetized benefits of the rule, at a 2 percent near-term discount rate, under the low and high scenarios, respectively.

Note that the EPA did not quantify the potential emissions changes associated with the production and delivery of CCT chemicals, and the construction required for the installation of CCT technology, and the production and transport of copper and plastic replacement piping and plumbing components. The EPA recognizes that many activities directly and indirectly associated with drinking water treatment produce GHG emissions; however, the agency determined that it could not accurately quantify all the potential factors that could increase and decrease greenhouse gas emissions that are not solely attributable to the direct onsite CCT operations and SLR field operations directly required by the rule. The EPA also notes that this analysis uses the 2021 LCRR as a baseline in order to calculate the incremental GHG emissions.

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6 Comparison of Costs to Benefits

This chapter compares the incremental costs and benefits of the final Lead and Copper Rule Improvements (LCRI). As a reminder, the incremental cost is the difference between costs that will be incurred under the final LCRI and the costs that would have been incurred if the 2021 Lead and Copper Rule Revisions (LCRR) and other State regulations requiring lead service line replacement (LSLR)that go beyond the 2021 LCRR LSLR requirements (Illinois, Michigan, New Jersey, and Rhode Island) remained in place with no changes. The baseline also accounts for resent LCRI compliant tap sampling in schools and child cares, in 17 states and the District of Columbia, which reduces the estimated incremental burden for both the 2021 LCRR and LCRI tap sampling requirements. For additional information of baseline characterization see Chapter 3. In Section 6.1, the United States Environmental Protection Agency (the EPA) summarizes the incremental costs that were discussed in detail in Chapter 4. In Section 6.2, the EPA summarizes the incremental benefits that were presented in Chapter 5. Finally, in Section 6.3 the EPA compares the incremental costs and benefits.

6.1 Summary of the Incremental Costs of the Final LCRI

6.1.1 Monetized Incremental Costs

Exhibit 6-1 provides the estimated incremental costs of the final LCRI, for both the low and high scenarios, at a 2 percent discount rate in millions of 2022 dollars.

Exhibit 6-1: Estimated National Annualized Monetized Incremental Costs of the Final LCRI at 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	LCRI	Incremental	Baseline	LCRI	Incremental
PWS Annual Costs						
Sampling	$134.0	$166.0	$32.0	$143.6	$176.2	$32.6
PWS SLR*	$84.6	$1,259.0	$1,174.4	$124.5	$1,763.9	$1,639.4
Corrosion Control Technology	$552.0	$591.1	$39.1	$647.8	$692.9	$45.1
Point-of Use Installation and Maintenance	$2.4	$5.1	$2.7	$5.9	$9.6	$3.7
Public Education and Outreach	$69.6	$267.3	$197.7	$72.1	$302.2	$230.1
Rule Implementation and Administration	$0.1	$3.4	$3.3	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$842.7***	***$2,291.9***	***$1,449.2***	***$994.1***	***$2,948.2***	***$1,954.1***
Household SLR Costs**	$8.1	$0.0	-$8.1	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$38.4	$66.1	$27.7	$41.8	$67.6	$25.8
Wastewater Treatment Plant Costs***	$3.0	$3.0	$0.0	$4.8	$5.1	$0.3
Total Annual Rule Costs	**$892.2**	**$2,361.0**	**$1,468.8**	**$1,067.1**	**$3,020.9**	**$1,953.8**

Acronyms: LCRI = Lead and Copper Rule Improvements; SLR = lead service line replacement; PWS = public water system; USD = United States dollars.

Notes: Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.

*Service line replacement includes full and partial lead service lines and galvanized requiring replacement service lines.

**The EPA in the 2021 LCRR economic analysis (USEPA, 2020a) assumed that the cost of customer-side service line replacements made under the goal-based replacement requirement would be paid for by households. The agency also assumed that system-side service line replacements under the goal-based replacement requirement and all service line replacements (both customer-side and systems-side) would be paid by the PWS under the 3 percent mandatory replacement requirement. The EPA made these modeling assumptions based on the different levels of regulatory responsibility systems faced operating under a goal-based replacement requirement versus a mandatory replacement requirement. While systems would not be subject to a potential violation for not meeting the replacement target under the goal-based replacement requirement, under the 3 percent mandatory replacement requirement the possibility of a violation could motivate more systems to meet the replacement target even if they had to adopt customer incentive programs that would shift the cost of replacing customer-side service lines from customers to the system. To be consistent with these 2021 LCRR modeling assumptions, under the final LCRI, the EPA assumed that mandatory replacement costs would fall only on systems. Therefore, the negative incremental values reported for the "Household SLR Costs" category do not represent a net cost savings to households. They represent an assumed shift of the estimated service line replacement costs from households to systems. The EPA has insufficient information to estimate the actual service line replacement cost sharing relationship between customers and systems at the national level of analysis.

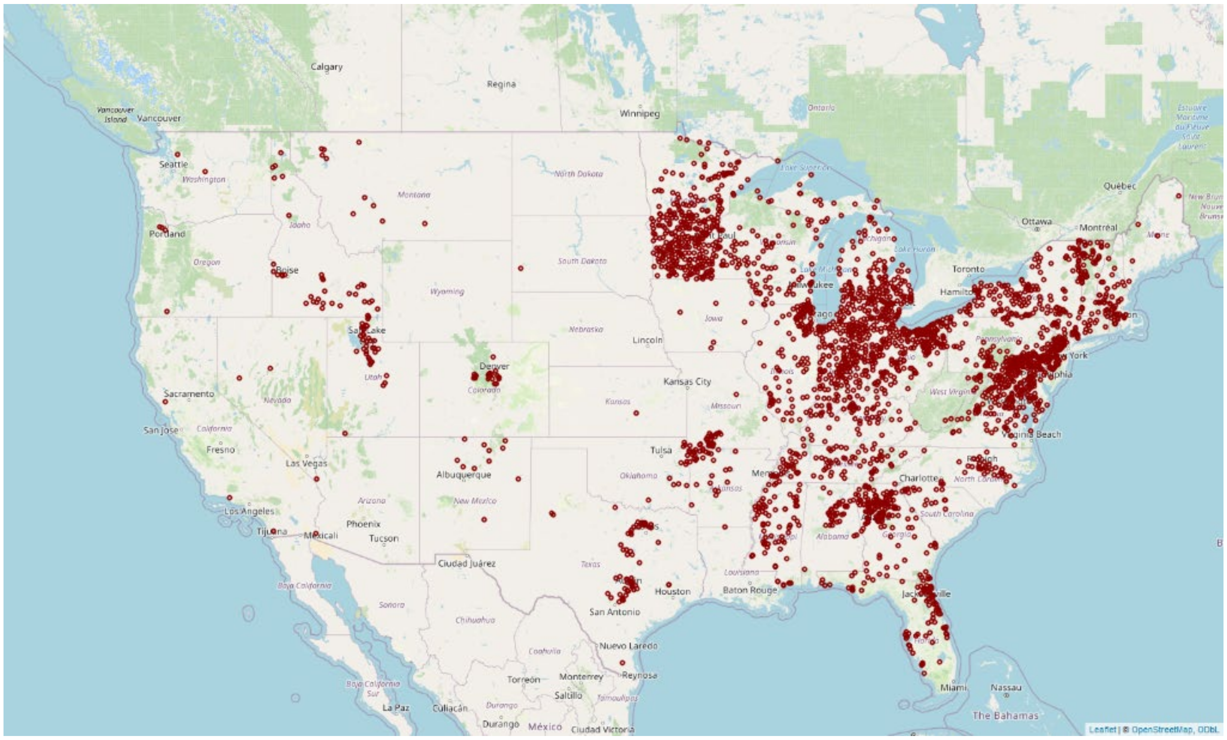
***Due to many water systems operating both the wastewater and drinking water systems, the EPA is evaluating the costs of additional phosphate usage for informational purposes. These costs are not “likely to occur solely as a result of compliance” with the final LCRI, and therefore are not costs considered as part of the Health Risk Reduction and Cost Analysis (HRRCA) under the Safe Drinking Water Act (SDWA), section 1412(b)(3)(C)(i)(III).

6.1.2 Non-monetized and Non-quantified Costs

As discussed in Section 4.5 of Chapter 4, the final LCRI is expected to result in additional phosphate being added to drinking water to reduce the amount of lead leaching into the water in the distribution system. Although the downstream ecological impacts are not “likely to occur solely as a result of compliance” with the final LCRI, and therefore are not costs considered as part of the Health Risk Reduction and Cost Analysis (HRRCA) under the Safe Drinking Water Act (SDWA), section 1412(b)(3)(C)(i)(III), the EPA for informational purposes has quantified incremental phosphorus loadings and outlined potential downstream ecological impacts. The SafeWater LCR model estimated that, nationwide, the final LCRI may result in post wastewater treatment plant (WWTP) total incremental phosphorus loads to receiving waterbodies increasing over the period of analysis, under the low and high scenarios, by a range of 225,000 to 272,000 pounds fifteen years after promulgation, and by a range of 216,000 to 260,000 pounds at Year 35. At the national level, under the high scenario, this additional phosphorus loading to waterbodies is relatively small, less than 0.03 percent of the total phosphorous load deposited annually from all other anthropogenic sources.

However, while the percent increase in phosphorus loadings nationally, due to the LCRI corrosion control treatment (CCT) requirements, is small in relation to all other sources of phosphorous, it is possible that the additional phosphorous loadings may result in negative localized impacts, such as eutrophication, in water bodies with elevated phosphorous levels that do not yet have restrictions on additional phosphate loadings. Exhibit 6-2 shows the location of WWTPs that discharge into waterbodies that currently have phosphorous limits in place. There is a significant concentration of these plants in the Great Lakes region as well as in New England and the mid-Atlantic regions. It is reasonable to assume that other waterbodies in these regions would be at higher risk of experiencing negative localized ecological impacts associated with the increases in phosphorous loadings resulting from the LCRI CCT requirements.

Exhibit 6-2: Wastewater Treatment Plants with Phosphorous Limits in 2024



Source: USEPA. 2024b. Water Pollution Search. https://echo.epa.gov/trends/loading-tool/water-pollution-search

The EPA also notes that there exist unquantified costs associated with service line replacement (SLR). Costs associated with the disruption of normal traffic patterns in communities implementing SLR programs are not accounted for in the monetized cost estimates of the rule. This impact to traffic could be significant in localized areas where lead, galvanized requiring replacement (GRR), and unknown service lines are co-located with high traffic roads. During SLR worksite activities and characteristics have the potential to increase car and pedestrian accidents. Also given the necessity to shut off water service to buildings and residences during SLR the probability of fire damage and negative health/sanitation impacts may increase. Given that SLR takes a relatively small amount of time (4 hours on average), the low probability of accidents and fire, the advance notice provided to building occupants, and alternative local sources of water available in emergencies (*e.g.,* fire hydrants), it is unlikely that these unquantified cost are nationally significant.

6.2 Summary of the Incremental Benefits of the Final LCRI

6.2.1 Monetized Incremental Benefits

Exhibit 6-3 shows the estimated incremental monetized benefits of the final LCRI at a 2 percent discount rate under the low and high benefit scenarios. The benefit values are also broken out by the quantified

and monetized health endpoints stemming from avoided reductions in intelligence quotient (IQ) and cases of Attention-Deficit/Hyperactivity Disorder (ADHD) in children, lower birth weights in children of women of childbearing age, and cases of cardiovascular disease (CVD) premature mortality in adults.

Exhibit 6-3: Estimated National Annualized Monetized Benefits of the Final LCRI at 2 Percent Discount Rate (millions of 2022 USD)

	Low Estimate			High Estimate		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual Child Cognitive Development Benefits	$1,208.5	$6,831.3	$5,622.8	$3,279.0	$10,963.0	$7,684.0
Annual Low-Birth Weight Benefits	$1.0	$5.4	$4.4	$1.8	$5.7	$3.9
Annual ADHD Benefits	$33.6	$196.3	$162.7	$179.9	$599.5	$419.6
Annual Adult CVD Premature Mortality Benefits	$1,750.7	$9,454.3	$7,703.6	$8,174.9	$25,210.0	$17,035.1
Total Annual Benefits	**$2,993.8**	**$16,487.3**	**$13,493.5**	**$11,635.6**	**$36,778.2**	**$25,142.6**

Acronyms: ADHD = Attention-Deficit/Hyperactivity Disorder; CVD = cardiovascular disease; LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

The EPA is committed to understanding and addressing climate change impacts in carrying out the agency's mission of protecting human health and the environment. While the EPA is not required by SDWA 1412(b)(3)(C)(i)(III) to consider climate disbenefits under the HRRCA, the agency has estimated the potential climate disbenefits caused by increased greenhouse gas (GHG) emissions associated with the operation of CCT at drinking water treatment facilities and the use of construction and transport vehicles in the replacement of lead and GRR service lines. As explained in section VI.A of the preamble, this disbenefits analysis is presented solely for the purpose of complying with Executive Order 12866.

The EPA analysis found that the climate disbenefits of the final LCRI from CO_2, CH_4, and N_2O emissions associated with increased electricity use in the operation of CCT at drinking water treatment facilities and the direct combustion of fossil fuels from the use of construction and transport vehicles in the replacement of lead and GRR service lines resulted in monetized annualized values that range from $2.1 million under the low scenario to $2.0 million under the high scenario discounted at 2 percent, in 2022 dollars. These disbenefit values constitute less than 0.02- 0.01 percent of the monetized benefits of the rule, at a 2 percent discount rate, under the low and high scenarios, respectively. Note that the EPA did not quantify the potential emissions changes associated with the production and delivery of CCT chemicals, the construction required for the installation of CCT technology, and the production and transport of copper and plastic replacement piping and plumbing components. The EPA recognizes that many activities directly and indirectly associated with drinking water treatment produce GHG emissions; however, the agency determined that it could not accurately quantify all the potential factors that could increase and decrease greenhouse gas emissions that are not solely attributable to the onsite CCT

operations and SLR field operations directly required by the rule. The EPA also notes that this analysis uses the 2021 LCRR as a baseline in order to calculate the incremental GHG emissions.

6.2.2 Non-monetized and Non-quantified Benefits

In addition to the benefits monetized in the final LCRI analysis for reductions in lead exposure, there are several other benefits that are not quantified. The risk of adverse health effects due to lead exposure that are expected to decrease as a result of the final LCRI are summarized in Appendix D and are expected to affect both children and adults. The EPA focused its non-quantified impacts assessment on the endpoints identified using two comprehensive United States Government documents summarizing the literature on lead exposure health impacts. These documents are the EPA's Integrated Science Assessment for Lead (ISA) (USEPA, 2024), and the United States Department of Health and Human Services' National Toxicology Program (NTP) Monograph on Health Effects of Low-Level Lead (NTP, 2012). Both sources present comprehensive reviews of the literature as of the time of publication on the risk of adverse health effects associated with lead exposure. The EPA summarized those endpoints to which either the EPA ISA or the NTP Lead Monograph assigned one of the top two tiers of confidence in the relationship between lead exposure and the risk of adverse health effects. These endpoints include cardiovascular morbidity effects, renal effects, reproductive and developmental effects (apart from ADHD and low birth weight initial hospitalization), immunological effects, neurological effects (apart from children's IQ), and cancer.

There are a number of final LCRI requirements that reduce lead exposure to both children and adults that the EPA could not quantify. The final rule will require additional lead public education requirements that target consumers directly, schools and child care facilities, health agencies, and people living in homes with lead and GRR service lines. Increased education will lead to additional averting behavior on the part of the exposed public, resulting in reductions in the negative impacts of lead. The rule will also require the development of service line inventories that include additional information on lead connectors and make the location of the lead content service lines publicly accessible. This will give potentially exposed consumers more information and will provide potential home buyers with this information as well. Homeowners may request lead service lines (LSL)/GRR service line removal earlier than a water system might otherwise plan on replacing the line. The benefits of moving these lead and GRR service line removals forward in time are not quantified in the analysis of the final LCRI. Because of the lack of granularity in the lead tap water concentration data available to the EPA for the regulatory analysis, the benefits of small improvements in CCT to individuals residing in homes with lead content service lines, like those modeled under the Distribution System and Site Assessment requirements, are not quantified.

The EPA also did not quantify the CCT benefits of reduced lead exposure from lead-containing plumbing components (not including from lead and/or GRR service lines) to individuals who reside in both: 1) homes that have lead and/or GRR service lines but also have other lead-containing plumbing components, and 2) those that do not have lead and/or GRR service lines but do have lead-containing plumbing components.[208] The EPA has determined that the final LCRI requirements may result in

[208] Although the EPA estimated an average lead concentration for the first 10 liters of drinking water to inform the water lead concentration estimates used to quantify benefits the EPA could not calculate the CCT benefits

reduced lead exposure to the occupants of both these types of buildings as a result of improved monitoring and additional actions to optimize CCT. In the analysis of the LCRI, the number of both homes served by lead and/or GRR service lines and homes not served by lead and/or GRR service lines potentially affected by water systems increasing their corrosion control during the 35-year period of analysis is 5.2 million in the low scenario and 9.1 million in the high scenario. Some of these households may have leaded plumbing materials apart from lead or GRR service lines, including lead connectors, leaded brass fixtures, and lead solder. These households could potentially see reductions in tap water lead concentrations.

Some researchers have pointed to the potential for CCT cobenefits associated with reduced corrosion, or material damage, to plumbing pipes, fittings, and fixture, and appliances that use water owned by both water systems and homeowners (Levin, 2023). The corrosion inhibitors used by systems that are required to install or re-optimize CCT as a result of the final LCRI are expected to result in additional benefits associated with the increased useful life of the plumbing components and appliances (*e.g.*, water heaters), reduced maintenance costs, reduced treated water loss from the distribution system due to leaks, and reduced potential liability and damages from broken pipes in buildings that receive treated water from the system. The replacement of GRR service lines may also lead to reduced treated water loss from the distribution system due to leaks (AwwaRF and DVGW-Technologiezentrum Wasser, 1996). The EPA did not have sufficient information to estimate these impacts nationally for the final rule analysis.

Additionally, the risk of adverse health effects associated with copper that are expected to be reduced by the final LCRI are summarized in Appendix E. These risks include acute gastrointestinal symptoms, which are the most common adverse effect observed among adults and children. In sensitive groups, there may be reductions in chronic hepatic effects, particularly for those with rare conditions such as Wilson's disease and children predisposed to genetic cirrhosis syndromes. These diseases disrupt copper homeostasis, leading to excessive accumulation that can be worsened by excessive copper ingestion (NRC, 2000).

6.3 Comparison of Incremental Costs to Incremental Benefits

Exhibit 6-4 and Exhibit 6-5 compare the yearly undiscounted incremental cost and benefits under the low and high scenario, respectively. The incremental costs of the rule are highest between 2027 to 2036 as public water systems (PWSs) are replacing SLs with lead content. In year 14 costs drop considerably. The incremental benefits of the rule generally increase over time as SLs with lead content are replaced. Yearly incremental net benefits are positive in the first three periods as a result of larger spending under the baseline 2021 LCRR. Starting in year 2027, incremental net benefits are negative for a period of 5 years. Over the remainder of the period of analysis incremental yearly net benefits are positive. Total undiscounted net benefits range from $479 billion to $918 billion.

associated with lead containing plumbing components (apart from lead and/or LSL/GRR service lines), because the EPA used a pooled estimate for all CCT conditions in residences with no lead and/or LSL/GRR service lines in place (See Chapter 5, section 5.2.3 for additional information).

Exhibit 6-4: Comparison of Yearly Monetized National Incremental Costs to Benefits of the LCRI under Low Scenario (millions 2022 USD)

Year	Yearly Incremental Costs	Yearly Incremental Benefits	Yearly Net Benefits
2024	-$614.3	-$14.0	$600.3
2025	-$211.2	-$41.9	$169.3
2026	-$308.1	-$83.9	$224.2
2027	$4,577.3	$245.8	-$4,331.4
2028	$3,856.1	$784.1	-$3,072.1
2029	$4,021.3	$1,396.5	-$2,624.8
2030	$4,435.3	$2,110.4	-$2,324.9
2031	$4,576.8	$2,948.5	-$1,628.2
2032	$3,885.6	$4,629.2	$743.6
2033	$3,775.9	$6,346.3	$2,570.4
2034	$3,729.4	$8,051.5	$4,322.1
2035	$3,756.7	$9,905.9	$6,149.2
2036	$3,779.8	$11,970.0	$8,190.2
2037	$306.7	$14,234.0	$13,927.3
2038	$199.3	$16,477.2	$16,277.9
2039	$190.0	$18,082.5	$17,892.6
2040	$208.5	$19,518.9	$19,310.4
2041	$210.0	$20,802.9	$20,592.9
2042	$278.9	$21,627.3	$21,348.4
2043	$204.4	$22,314.1	$22,109.7
2044	$159.4	$22,709.9	$22,550.5
2045	$166.7	$22,966.6	$22,799.8
2046	$166.7	$23,075.3	$22,908.6
2047	$188.3	$23,034.7	$22,846.4
2048	$251.2	$22,991.5	$22,740.3
2049	$90.9	$22,945.4	$22,854.6

Year	Yearly Incremental Costs	Yearly Incremental Benefits	Yearly Net Benefits
2050	$250.1	$22,895.3	$22,645.3
2051	$291.3	$22,840.4	$22,549.1
2052	$426.5	$22,787.1	$22,360.6
2053	$190.1	$22,730.3	$22,540.2
2054	$186.7	$22,671.9	$22,485.2
2055	$184.7	$22,612.4	$22,427.7
2056	$183.9	$22,550.3	$22,366.4
2057	$258.1	$22,489.6	$22,231.6
2058	-$25.4	$22,427.6	$22,452.9

Acronyms: LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

Exhibit 6-5: Comparison of Yearly Monetized National Incremental Costs to Benefits of the LCRI under High Scenario (millions 2022 USD)

Year	Yearly Incremental Costs	Yearly Incremental Benefits	Yearly Net Benefits
2024	-$888.7	-$52.3	$836.5
2025	-$435.6	-$155.7	$279.9
2026	-$657.0	-$311.6	$345.4
2027	$5,803.7	$546.9	-$5,256.8
2028	$4,898.9	$1,797.6	-$3,101.3
2029	$5,588.0	$3,113.9	-$2,474.1
2030	$6,320.7	$4,146.0	-$2,174.7
2031	$6,758.6	$5,195.1	-$1,563.5
2032	$5,339.0	$8,039.9	$2,700.9
2033	$5,176.1	$11,080.5	$5,904.4
2034	$5,139.5	$14,184.6	$9,045.2
2035	$5,169.0	$17,237.3	$12,068.3
2036	$5,190.3	$21,067.2	$15,876.9
2037	$306.3	$25,611.1	$25,304.8
2038	$199.3	$30,085.7	$29,886.5
2039	$193.5	$32,917.9	$32,724.4

Year	Yearly Incremental Costs	Yearly Incremental Benefits	Yearly Net Benefits
2040	$219.8	$35,508.0	$35,288.2
2041	$222.3	$38,242.8	$38,020.5
2042	$289.4	$40,437.2	$40,147.8
2043	$217.5	$42,346.4	$42,128.8
2044	$185.1	$43,182.3	$42,997.2
2045	$196.6	$43,705.1	$43,508.5
2046	-$44.6	$43,903.8	$43,948.4
2047	$105.8	$43,769.1	$43,663.3
2048	-$155.4	$43,627.0	$43,782.4
2049	$476.8	$43,479.7	$43,002.9
2050	$128.0	$43,324.6	$43,196.6
2051	$777.1	$43,162.7	$42,385.6
2052	$363.0	$42,999.4	$42,636.5
2053	$427.8	$42,829.2	$42,401.5
2054	$263.3	$42,656.7	$42,393.4
2055	$238.4	$42,482.6	$42,244.2
2056	$208.6	$42,305.6	$42,097.0
2057	$271.1	$42,130.3	$41,859.2
2058	-$424.2	$41,952.8	$42,377.0

Acronyms: LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

Exhibit 6-6 compares the estimated annualized monetized incremental costs and the estimated annualized monetized incremental benefits of the final LCRI at a 2 percent discount rate; the monetized net annualized incremental benefits range from $12.0 billion to $23.2 billion.

Exhibit 6-6: Comparison of Estimated Monetized National Annualized Incremental Costs to Benefits of the LCRI - 2 Percent Discount Rate (millions 2022 USD)

	Low Scenario	High Scenario
Annualized Incremental Costs	$1,468.8	$1,953.8
Annualized Incremental Benefits	$13,493.5	$25,142.6
Annual Net Benefits	**$12,024.7**	**$23,188.8**

Acronyms: LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

It is important to note that, as described in Chapter 4, the EPA determined it does not have enough information to perform a probabilistic uncertainty analysis as part of the SafeWater LCR model analysis for this rule. Instead, to capture uncertainty, the EPA estimated compliance costs (and benefits) by running the SafeWater LCR model under low and high bracketing scenarios. For costs, the bracketing scenarios are defined by the following three cost drivers:

1. Likelihood a model PWS will exceed the lead action level (AL) and/or trigger level (TL) under the 2021 LCRR and the AL under the final LCRI.
2. LSLR unit costs.
3. CCT unit costs.

The low and high benefits bracketing scenarios are defined by the following benefits variables:

1. Likelihood a model PWS will exceed the AL and/or TL under the 2021 LCRR and the AL under the final LCRI (also used to define the low and high cost scenarios in the cost analysis).
2. The concentration-response functions that characterize how reductions in blood lead levels (caused by changes in lead exposure) translate into avoided IQ reductions, cases of ADHD, and CVD premature mortality.
3. Two alternative low and high valuations for the ADHD cost of illness.

The EPA expects the significant portion of potential uncertainty is captured by this bracketing approach. However, some uncharacterized uncertainties still exist which may result in cost and benefit estimates that fall outside of the range of costs and benefits described in the bracketing model results.

Unquantified uncertainty associated with the quantified cost estimates can come from a number of sources. There may be uncaptured variation in the three variables that define the low and high cost scenarios. In general the agency estimated bracketing values that captured national average variability, therefore extreme measures were not included. The EPA used the 25th and 75th percentiles from the 7th Drinking Water Infrastructure Needs Survey and Assessment (DWINSA) dataset on SLR costs to define average national cost of SLR but additional information from the dataset shows that lower or higher SLR costs can be found across some systems. The CCT unit cost range derived in the work breakdown structure (WBS) models represents reasonable low and high estimated CCT costs based on quality of treatment system components and average assumptions about the complexity of the CCT system and on-site installation requirements. These values may not capture all potential variability in site specific requirements across systems. The estimated 90th percentile range is based on the range in the Safe Drinking Water Information System (SDWIS) reported data of the period from 2012 to 2020. The degree to which this is representative of future sample variation is uncertain, although in this case the range is based on the maximum and minimum 90th percentiles reported for each system which should capture a significant portion of the variability. Also, there is uncertainty in the adjustments the EPA makes to the SDWIS data to account for changes in tap sampling requirements which may introduce uncertainty. Uncertainty, in this value, affects the number of systems required by the rule to install or re-optimize CCT, and distribute point-of-use (POU) devices, potentially significantly impacting cost estimates. In addition to the three variables defining the low/high range uncertainty in the baseline information on the number of lead, GRR, and unknown service lines, and the number of systems with CCT in-place and the starting values for pH and orthophosphate at PWSs with existing CCT all are potential sources of uncertainty that could significantly affect computed cost estimates. Lesser drivers of cost estimate unquantified variability include the uncertainty associated with smaller burden and unit costs estimates,

many of which are point estimates, tied to a number of required activities from rule implementation and recordkeeping to sampling and public education. Generally, the EPA does not have data to determine if the uncertainty associated with cost inputs would systematically lead to an over or under estimate of the national level quantified estimated costs.

Regarding the benefits estimates, again there is unquantified uncertainty associated with the variables that define the estimated range. Uncertainty in the estimation of the 90th percentile values affect benefits in the same way it affects costs, potentially not capturing the complete variation in systems being required to conduct CCT installation or re-optimization, and POU distribution impacting both cost and benefit values. There is uncertainty about which statistical functions best describes the relationship between blood lead and health effects which may be only partially captured by the estimated functions from the studies the EPA uses to bracket the quantified benefit estimates. Also, there is uncertainty in the extrapolation of concentration-response functions between lead and adverse health effects to blood lead levels lower than those observed in the original studies. There is also uncertainty on the timing of blood lead measurements in relation to the health effects, as low birth weight (LBW), CVD premature mortality and ADHD rely on one time-blood lead measurements. For IQ, this has been well studied with cohorts of children with repeated measures, and relationships were observed with all measures (Lanphear et al., 2015,2019). However, this level of detail was not available for other endpoints. Also, no cessation lag is assumed in the modeling. This would impact the monetary estimate for CVD premature mortality the most, potentially causing an overestimation of the monetary value of this avoided risk. Additionally, the use of cost of illness estimates for LBW and ADHD does not include an individual's willingness to pay to avoid health risk, or any reductions in quality of life due to the health condition, which may lead to an underestimation of benefits. Uncertainties in the value of an IQ point are described in detail in Appendix J of the LCRR Economic Analysis (USEPA, 2020). There may also be additional uncertainty associated with the persistence of ADHD into adulthood not accounted for in the EPA characterization using values from Barbaresi et al. (2013) and Sibley et al. (2022) to produce a range of low and high cost of illness estimates used in the valuation of ADHD cases.

In addition to the health endpoint valuation uncertainties there exists uncertainty related to the estimation of baseline and policy scenario drinking water lead concentrations that can affect the estimated benefits values. The data available to estimate these concentrations was limited, and the EPA relied on detailed information from 18,571 samples collected from 1,657 homes in 16 cities representing 15 city water systems across the United States and Canada. Modeling was then used to estimate the concentrations that were assumed to apply nationwide. It is unclear if better characterization of drinking water concentrations would result in higher or lower benefits estimates. In addition to the drinking water lead concentrations other background sources of lead from soil, air, and food were held constant when estimating BLLs. Given the many Federal and State lead reduction initiatives in these other lead source areas it is likely that over the period of analysis background lead exposure in the population will decrease. If lead levels in other media besides water are decreasing in the baseline, then this analysis would underestimate benefits from reductions due to the final LCRI because the dose-response functions for IQ, low birth weight, and CVD premature mortality are log linear and that the concentration response functions show no evidence of a threshold below which effects cease. The EPA also does not account for the presence and degree of averting behavior which would take place in the baseline 2021 LCRR or the final LCRI. The relative degree of averting behavior that could be present across the regulatory scenarios could impact the incremental benefits of the rule.

The EPA also considered both monetized and non-monetized costs and benefits for the final rule; see Sections VI.F.1 and VI.F.2 of the final rule *Federal Register* Notice.

The EPA, in April 2024, finalized the PFAS National Primary Drinking Water Regulation. The PFAS rule's total annualized cost is expected to be $1.5 billion in2022 dollars discounted at 2 percent. The PFAS rule has estimated total annualized benefits also of $1.5 billion in 2022 dollars discounted at 2 percent. For additional detailed information on the PFAS rule and its potential costs and benefits see the PFAS final rule Federal Register Notice (88 FR 18638). Implementation timing associated with this PFAS rule and the final LCRI has the potential to overlap. To the extent implementation overlaps, some rule start-up, administrative, and sampling/SL inventory costs associated with both rules could affect a large number of PWSs and States. The more significant costs of installing and operating PFAS treatment technology in a similar time frame with installing and operating CCT and/or conducting service line replacement are expected to fall on some systems. The EPA does not have sufficiently detailed PFAS occurrence, and LSL/GRR service line and 90th percentile lead tap sample data to explore the potential treatment cost interactions of the two rules. The EPA further notes that SDWA section 1412(b)(3)(C)(i)(III) requires that the EPA include quantifiable and non-quantifiable costs that are likely to occur solely as a result of compliance with the rule including monitoring, treatment and other costs and excluding costs resulting from compliance with other proposed or promulgated regulations.

6.4 References

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7 Statutory and Administrative Requirements

7.1 Introduction

As part of the rulemaking process, the United States Environmental Protection Agency (EPA) is required to address the direct and indirect burden that the final Lead and Copper Rule Improvements (LCRI) may place on certain types of governments, businesses, and populations. This chapter presents analyses performed by the EPA in accordance with the following federal mandates and statutory requirements:

- Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review.
- Paperwork Reduction Act (PRA).
- The Regulatory Flexibility Act (RFA) of 1980, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996.
- Unfunded Mandates Reform Act (UMRA) of 1995.
- Executive Order 13132: Federalism.
- Executive Order 13175: Consultation and Coordination with Indian Tribal Governments.
- Executive Order 13045: Protection of Children from Environmental Health and Safety Risks.
- Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use.
- National Technology Transfer and Advancement Act of 1995 (NTTAA).
- Executive Order 12898: Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations and Executive Order 14096 (Revitalizing Our Nation's Commitment to Environmental Justice for All).
- The Safe Drinking Water Act (SDWA) required consultations with the Science Advisory Board (SAB), National Drinking Water Advisory Council (NDWAC), and the Secretary of Health and Human Services.

Many of the statutory requirements and executive orders listed above call for an explanation of why the final LCRI requirements are necessary, the statutory authority for the requirements, and the primary objectives that the final requirements are intended to achieve (see Chapter 2 for additional information regarding the goals of the final LCRI). Others are designed to assess the financial and health effects of the final regulatory requirements on sensitive, low-income, and tribal populations as well as on small systems and governments.

7.2 Executive Order 12866: Regulatory Planning and Review and Executive Order 14094: Modernizing Regulatory Review

Executive Order 12866, *Regulatory Planning and Review* (58 FR 51735, October 4, 1993), gives the Office of Management and Budget (OMB) the authority to review regulatory actions that are categorized as

"significant" under Section 3(f) of Executive Order 12866 as modified by Section 1 of Executive Order 14094 (88 FR 21879, April 6, 2023). The Order defines a "significant regulatory action" as any regulatory action that is likely to result in a rule that may:

1. Have an annual effect on the economy of $200 million or more (adjusted every three years by the Administrator of the Office of Information and Regulatory Affairs (OIRA) for changes in gross domestic product;) or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

2. Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

3. Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

4. Raise legal or policy issues for which centralized review would meaningfully further the President's priorities or the principles set forth in this Executive order, as specifically authorized in a timely manner by the Administrator of OIRA in each case.

This action is significant under section 3(f)(1) of Executive Order 12866 and was submitted to the OMB for review. Any changes made in response to recommendations arising from OMB's review process have been documented in the docket. In Chapter 6, Exhibit 6-6, compares the monetized annual estimated incremental costs and the monetized annual incremental benefits of the final LCRI at a 2 percent discount rate. The net monetized annual incremental benefits range from $12 to $23 billion. The range in reported values represent cost-benefit estimation under the low and high scenarios developed by the agency to characterize uncertainty in the computed estimates.

In addition to the monetized costs and benefits of the final LCRI, a number of non-monetized and non-quantified impacts exist. See Chapter 6, Sections 6.1.2 and 6.2.2 for a detailed listing of the non-monetized costs and non-quantified benefits, respectively, associated with the lead exposure reductions of the final LCRI.

7.3 Paperwork Reduction Act

The information collection requirements for the final LCRI have been submitted for approval to OMB under the PRA, 44 U.S.C. 3501 *et seq*. The Information Collection Request (ICR) document that the EPA prepared has been assigned the EPA ICR number 2788.02 and is available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

The PRA requires the EPA to estimate the burden, as defined in 5 CFR 1320.3(b), on systems and States of complying with the rule. ("State" is used throughout this chapter to describe States, Tribes, and territories with primary enforcement responsibility.) The information collected as a result of the final LCRI should allow States and the EPA to determine appropriate requirements for specific systems and evaluate compliance with the final LCRI. Burden is defined at 5 CFR 1320.3(b) and means the total time, effort, and financial resources required to generate, maintain, retain, disclose, or provide information to

or for a federal agency. The burden includes the time needed to conduct State and system activities during the first three years after promulgation, as described in Sections 7.3.1 and 7.3.2, respectively.

7.3.1 State Activities

The EPA anticipates States will be involved in the following activities for the first three years after publication of the final LCRI:

Implementation

- Adopt the rule and develop implementation program.
- Modify data management systems.
- Provide State staff training.
- Provide water system staff with training and technical assistance for implementation.
- Review the updated Lead and Copper Rule Revisions (LCRR) initial inventories that will contain lead connector information and public water system (PWS) demonstrations and written statements of only non-lead service lines, non-lead connectors, or no connectors present from systems in lieu of a publicly accessible inventory data.
- Review water system service line replacement plans, including reviewing information on deferred deadline and associated replacement rate in the SLR plan and determine fastest feasible rate.
- Provide a template for the public education materials on lead, GRR, and unknown service lines that water systems must deliver annually to customers served by those types of lines.
- Review the public education materials on lead, GRR, and unknown service lines that water systems develop to be delivered annually to customers served by those types of lines.
- Review the updated tap sampling plans.

7.3.2 System Activities

The EPA anticipates systems will be involved in the following activities for the first three years after publication of the final LCRI:

Implementation

- Read and understand the rule.
- Assign personnel and resources for rule implementation.
- Attends training and receive technical assistance from the State.
- Update and submit to the State a service line inventory that includes lead connector information.

- Develop and submit to the State a service line replacement plan, including information on participation in a deferred replacement plan, if eligible, and identifying funding options for full service line replacements.
- Update unknown service lines through normal field operations.
- Develop and submit to the State public education materials on lead, GRR, and unknown service lines that must be delivered annually to customers served by those types of lines.
- Annually distribute public education materials on lead, GRR, and unknown service lines to customers served by those types of lines.
- Update and submit to the State a tap sampling plan.

For the first three years after publication of the rule in the *Federal Register*, the major information requirements apply to 67,003 respondents annually, including 66,947 PWSs and 56 Primacy Agencies. The net change in burden associated with moving from the information requirements of the 2021 LCRR to those in the final LCRI over the three years covered by the ICR is -916,723 hours, for an average of -305,574 hours per year. The total net change in costs from the most recent ICR approved for the 2021 LCRR[209] over the three-year compliance period covered by this ICR are $131.5 million, for an average of $43.8 million per year (simple average over three years). The net average burden per response (*i.e.*, the amount of time needed for each activity that requires a collection of information) is -0.11 hours; the net average cost per response is -$6.65. Because the final LCRI requirements will nullify most of the requirements of the 2021 LCRR during the three-year implementation period for the LCRI, the burden for the final LCRI is lower than the anticipated burden that would have occurred under the 2021 LCRR over the same period, resulting in a negative net burden for the final LCRI. The costs for system activities under the LCRI, however, are greater than those for the same period under the 2021 LCRR. The collection requirements are mandatory under the SDWA (42 U.S.C. 300j-4 subsections (a)(1)(A) and (a)(1)(B)). Details on the calculation of the final LCRI information collection burden and costs can be found in the ICR for the final LCRI and Chapter 4 of this economic analysis (EA).

A summary of the average annual net burden and costs of the collection is presented in Exhibit 7-1.

Exhibit 7-1: Estimated Change in Average Annual Net Burden and Costs for the Final LCRI ICR

Item	Burden (labor)	Labor Costs ($2022)	Non-Labor Costs ($2022)	Total Costs ($2022)	Responses
Systems	-79,849	1,546,949	$59,669,117	$61,216,127	37,771,470
States	-225,725	-17,366,566	0	-$17,366,566	-204,381
Total	-305,574	-15,819,617	$59,669,117	$43,849,560	37,567,089
Average per response	-0.11	-5.02	-$1.63	-$6.65	not applicable

Source: ICR Supporting Statement, available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.
Note: Calculated in 2022 dollars. Detail may not add to totals because of independent rounding. Results show the upper bound estimate for the number of lead lines located in non-transient non-community water systems

[209] Office of Management and Budget (OMB) approved the initial “Information Collection Request for Lead and Copper Rule Revisions (LCRR)” on July 25, 2022.

(NTNCWSs), Chapter 4 of this EA documents a difference of approximately five lines between the upper- and lower-bound estimates.

The total responses, burden, and cost for system and State startup activities, LSL inventory, public education, and service line replacement plan is provided in Exhibit 7-2.

Exhibit 7-2: Estimated Total Responses, Burden, and Costs for the Final LCRI ICR for Each Required Activity

Requirement	Responses	Burden (Hours)	Labor Cost ($2022)	Non-Labor Cost ($2022)	Total Cost ($2022)
System start-up activities (read rule, assign staff, attend training)	200,841	1,338,940	$50,720,720	$0	$50,720,720
Systems review records for connector material to prepare the updated initial inventory	200,841	4,469,095	$220,425,702	$0	$220,425,702
Systems submit the updated initial inventory with connector information	200,841	381,190	$14,596,761	$0	$14,596,761
Systems conduct normal and field operations to update unknown service lines	9,392,500	0	$0	$431,570,015	$431,570,015
Systems develop and submit a service line replacement plan	25,823	423,876	$17,510,054	$0	$17,510,054
Systems include information on deferred deadline and associated replacement rate in the SLR plan	5	33	$1,773	$0	$1,773
Systems identify funding options for full SLRs	25,360	1,838,704	$72,886,662	$0	$72,886,662
Systems develop public education materials for customers on service lines with lead or unknown content and submit to primacy agencies for review	25,823	180,761	$7,028,788	$0	$7,028,788
Systems distribute public education materials for customers on service lines with lead or unknown content	176,983,809	1,978,966	$87,823,986	$68,788,580	$156,612,566
Systems update and submit tap sampling plan	66,947	347,828	$13,823,729	$0	$13,823,729
System Subtotal	**187,122,790**	**10,959,392**	**$484,818,175**	**$500,358,595**	**$985,176,770**
States start-up activities (read rule, adopt rule, modify data systems, provide training)	224	399,168	$23,944,566	$0	$23,944,566

Requirement	Responses	Burden (Hours)	Labor Cost ($2022)	Non-Labor Cost ($2022)	Total Cost ($2022)
States review updated initial inventories with connector information	200,841	200,841	$12,047,686	$0	$12,047,686
States review service line replacement plan	25,823	205,690	$12,338,559	$0	$12,338,559
State reviews information on deferred deadline and associated replacement rate in the SLR plan and determine fastest feasible rate	5	16	$979	$0	$979
States provide templates to systems for public education on service lines with lead or unknown content and reviews developed material	25,823	23,767	$1,425,669	$0	$1,425,669
States review updated tap sampling plan	66,947	174,784	$10,484,626	$0	$10,484,626
State Subtotal	**319,663**	**1,004,266**	**$60,242,085**	**$0**	**$60,242,085**
Combined Systems and State	**187,442,453**	**11,963,658**	**$545,060,260**	**$500,358,595**	**$1,045,418,855**

Source: ICR Supporting Statement, available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov
Note: Calculated in 2022 dollars. Detail may not add to totals because of independent rounding. Results show the upper bound estimate for the number of lead lines located in NTNCWSs.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for the EPA's regulations in 40 CFR are listed in 40 CFR part 9.

7.4 The Regulatory Flexibility Act

The RFA of 1980, amended by the SBREFA of 1996, requires regulators to assess the effects of regulations on small entities including businesses, nonprofit organizations, and governments. RFA/SBREFA generally requires an agency to prepare a final regulatory flexibility analysis (FRFA) of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities (SISNOSE). Small entities include small businesses, small organizations, and small governmental jurisdictions.

The RFA provides default definitions for each type of small entity. Small entities are defined as: 1) a small business as defined by the Small Business Administration's (SBA) regulations at 13 CFR 121.201; 2) a small governmental jurisdiction that is a government of a city, county, town, school district, or special district with a population of less than 50,000; and 3) a small organization that is any "not-for-profit enterprise which is independently owned and operated and is not dominant in its field." However, the RFA also authorizes an agency to use alternative definitions for each category of small entity, "which are appropriate to the activities of the agency" after proposing the alternative definition(s) in the *Federal*

Register and taking comment (5 USC 601(3)-(5)). In addition, to establish an alternative small business definition, agencies must consult with SBA's Chief Counsel for Advocacy.

For purposes of assessing the impacts of the final LCRI on small entities, the EPA considered small entities to be systems serving 10,000 people or fewer. This is the cut-off level specified by Congress in the 1996 Amendments to SDWA for small system flexibility provisions. As required by the RFA, the EPA proposed using this alternative definition in the *Federal Register* (FR) (63 FR 7620, USEPA, 1998a), requested public comment, consulted with the SBA, and finalized the alternative definition in the agency's Consumer Confidence Reports (CCR) regulation (63 FR 44524, USEPA, 1998b). As stated in that Final Rule, the alternative definition would be applied for all future drinking water regulations.

The materials presented and referenced in this RFA section represent the EPA's regulatory flexibility analysis. They examine the impacts of the final rule on small entities along with regulatory alternatives that could minimize the impacts of the rulemaking.

7.4.1 Need for and Objectives of the Rule

The need for the rule, the objectives of the rulemaking, the stakeholder outreach conducted, and the statutory authority the EPA is utilizing to finalize the rule are described in detail in Chapter 2. See Section 2.1 for detailed information on the need for the rule and the Lead and Copper Rule's (LCR) regulatory history, Sections 2.2 through 2.4 for information on stakeholder outreach during the rulemaking process, and Section 2.5 for additional detail on the statutory authority for the promulgation of the final LCRI.

7.4.2 Summary of SBAR Comments and Recommendations

The EPA convened a Small Business Advocacy Review (SBAR) Panel to review the planned final LCRI and consult with small entity representatives (SERs) as required by Section 609(b) of the RFA and amended by the 1996 SBREFA. Prior to convening the Panel, the EPA conducted outreach with 11 out of 14 potential SERs through a pre-Panel outreach meeting held on September 12, 2022, to solicit input on the potential small systems implications of the forthcoming final LCRI. On November 15, 2022, the EPA's Small Business Advocacy Chairperson convened the Panel with the Director of the Standards and Risk Management Division within the EPA's Office of Ground Water and Drinking Water (OGWDW), the Administrator of the OIRA within OMB, and the Chief Counsel for Advocacy of the SBA. The Panel met with 8 out of 14 SERs to hear their comments on the planned final LCRI during the Panel outreach meeting held on November 29, 2022. Through the pre-Panel and Panel outreach meetings, the SERs provided feedback on key areas, including achieving 100 percent lead service line replacement (LSLR) in small systems, complying with a revised tap sampling protocol, complying with a revised action level (AL) and trigger level (TL) construct, reducing rule complexity, adding protection from sustained lead levels above the AL, and changing the 2021 LCRR small system flexibilities. SERs also provided feedback on additional topics, such as corrosion control treatment (CCT), schools, and public education.

The Panel's findings are summarized below.

Number and Types of Entities Affected

The SERs commented that some of the changes in the existing 2021 LCRR and final LCRI might pose problems for water systems serving fewer than 100 people and water systems that primarily serve

schools and child care facilities. The Panel recommended that the EPA evaluate whether it is appropriate to further differentiate LCRI requirements based on the differences among smaller water systems (*e.g.*, flexibilities for very small systems serving fewer than 500 people, small systems serving between 501 and 3,300 people, and small systems serving between 3,301 and 10,000 people). The Panel also recommended that the EPA consider the costs associated with multiple rule areas of the final LCRI requirements in the EA and ways to reduce the burden on small systems including the interrelationship amongst the areas of the rule requirements.

Recordkeeping, Reporting, and Other Compliance Requirements

The 2021 LCRR includes reporting and recordkeeping requirements for service line inventorying and replacement, monitoring results, public notification, public education, and sampling results. At the same time, the PRA requires that all reporting and recordkeeping requirements have practical utility and appropriately balance the needs of the government with the burden on the public. As the EPA proceeds with the final LCRI, the EPA assessed the need for revisions to 2021 LCRR reporting and recordkeeping requirements and considered them in the estimation of the burden and benefits of the rule changes. The EPA is committed to keeping paperwork requirements to the minimum necessary and to fulfill its statutory obligations as required by the PRA.

Related Federal Rules

There are National Primary Drinking Water Regulations for over 90 contaminants. The EPA's drinking water rules were developed with careful attention to the interaction between each new rule that requires treatment changes. The Panel recommended that the EPA continue to ensure that any revisions to the 2021 LCRR be coordinated with, and do not either duplicate or conflict with, the requirements of other drinking water regulations, and the EPA should consider other drinking water rule costs for small systems.

One of the treatment strategies that the pre-2021 LCR and 2021 LCRR identify for controlling lead and copper corrosion is to add orthophosphate to drinking water, which may impact the phosphorus levels in the wastewater discharges in communities, including those with numeric discharge criteria for phosphorous under the Clean Water Act. The Panel recommended that the EPA estimate the impacts of the addition of phosphate on wastewater treatment plants in the final LCRI. Some water systems are responsible for both the drinking water system as well as the wastewater treatment system. Under SDWA, the EPA is required to set regulatory standards that reduce adverse health effects to the extent feasible; this includes the lead and copper regulations. The EPA has previously determined that CCT is technologically feasible and affordable.

Regulatory Flexibility Alternatives

<u>Lead Service Line Replacement</u>

The EPA is finalizing improvements to the 2021 LCRR LSLR requirements under the LCRI, including a requirement to achieve the goal of replacing all lead and GRR service lines in the nation as quickly as feasible. In addition to regulatory requirements, the EPA has and will continue to take non-regulatory actions to achieve replacement of all lead and GRR service lines.

The Panel recognized the steps the EPA has taken, and will continue to take, to ensure federal funds are available to drinking water systems, especially those within disadvantaged communities. These funds include but are not limited to available funding through the Bipartisan Infrastructure Law (BIL), the

Drinking Water State Revolving Fund, and the Water Infrastructure Improvement for the Nation Act. Despite the many efforts the EPA takes to ensure federal funds are available to water systems, the Panel recognized that funding streams are not guaranteed to be available to all small systems, that some small systems may not pursue available funding opportunities for a variety of reasons, and that, in the absence of this funding, these communities may have difficulty financing LSLR. The Panel recommended that the EPA evaluate available recent data and LSLR cost information (including the EPA's Drinking Water Infrastructure Needs Survey and Assessment) to inform the EA for the final LCRI. When evaluating the cost of compliance, the Panel recommended that the EPA recognize that external funding sources may not be available to all small systems.

SERs identified factors such as customer engagement and cooperation, contractor availability, and supply chain issues that will challenge the rate at which they can replace 100 percent of their LSLs. When developing the LSLR requirements, the Panel recommended that the EPA consider the barriers to 100 percent LSLR that SERs identified that make LSLR challenging. In the 2021 LCRR, the EPA recognized that customers may refuse to participate in LSLR and required documentation of customer engagement. The Panel recommended that the EPA include a provision in the final LCRI to account for customer refusals in the mandatory LSLR provision and increase clarity in terms of what "good faith" attempts mean when engaging the customer. The Panel recommended that the EPA provide additional time for small systems to comply with applicable service line replacement requirements from the 2021 LCRR that are revised by the final LCRI, including a transition period following the effective date to provide time for small systems to plan replacement-required activities.

SERs expressed the importance of national-level technical assistance for small systems in both the pre-Panel and Panel meetings. Therefore, the Panel recommended that the EPA respond to SER concerns on the need for assistance in understanding and complying with the LCRI requirements. The EPA supports small systems through several different avenues, *i.e.*, developing guidance on the initial service line inventory, providing technical assistance through the Environmental Finance Centers, holding monthly webinars focused on issues small systems face, and hosting an annual drinking water workshop to bring together stakeholders in drinking water systems. Considering the SERs continued concerns and the degree to which technical assistance is crucial in reducing regulatory compliance costs, the Office of Advocacy recommended that the EPA continue to consult regularly with small entities and State regulatory authorities to ensure the efforts to provide technical assistance to small systems to address regulated and emerging contaminants are effective and remain appropriately targeted.

The EPA is including LCRI requirements that are intended to achieve more equitable human health protection outcomes, especially for service line replacement such as requiring the replacement plan to be made available to the public to increase transparency in the process. Due to the cost of replacing the customer-portion of an LSL, underserved communities could potentially experience disproportionate exposure to lead from LSLs if measures to ensure equity are not incorporated into the final LCRI. The EPA specifically asked for SER input about ways to ensure equitable service line replacement in the final LCRI. Multiple SERs stated that LSLR and other system repairs are generally based on (1) infrastructure needs and what may fail first rather than who the infrastructure serves and (2) how to complete the most pressing infrastructure work as efficiently as possible. One SER mentioned that equity should consider factors outside of finances, such as English as a second language and achieving proper communication and notice on construction projects.

The 2021 LCRR required LSLR plans to include a LSLR prioritization strategy based on factors including but not limited to the targeting of known LSLs, LSLR for disadvantaged consumers, and populations most sensitive to the effects of lead. Systems can include additional factors important to their community, *e.g.*, unknown service lines suspected to be lead, areas with pressing system repairs or infrastructure needs, areas with older homes, populations with higher blood lead levels based on available data. The Panel recommended that the EPA consider the range of additional factors raised by SERs in addition to equity principles when developing the final LCRI service line replacement plan and other service line replacement requirements (*e.g.*, areas with pressing system repairs, infrastructure needs, and areas with older homes).

Tap Sampling

In the LCRR review, the EPA concluded that there are opportunities to better identify the communities that are most at risk of elevated drinking water lead levels. For the final LCRI, the EPA evaluated alternative tap sampling protocols that may better identify higher lead levels.

The EPA is finalizing a new tap sampling protocol that requires systems to collect both first- and fifth-liter samples at LSL sites and to use the higher concentration for the 90th percentile lead level calculation. SERs discussed various factors that may pose challenges for small systems to comply with a new sampling protocol, including increased costs and burden for systems with LSLs, increased complexity of the protocol and communicating instructions to customers, and difficulty obtaining customer participation. SERs also expressed a lack of confidence in relying on homeowners to take routine samples and suggested ideas like developing training videos on how to take fifth-liter samples. Under the 2021 LCRR, systems with low 90th percentile lead levels and those without lead sources may reduce their monitoring frequency. By updating the sampling protocol, among other rule requirements, there will likely be additional systems that exceed the AL, thus requiring actions to reduce drinking water lead exposure not otherwise required in order to protect public health. The EPA accounted for the costs and benefits of these additional actions into consideration in the EA for the final LCRI. The Panel recommended that the EPA clarify aspects of the sampling protocol in the final LCRI rule language, such as a definition of a wide-mouth bottle, and provide additional time for small systems to comply with monitoring and sampling requirements from the 2021 LCRR that are revised by the LCRI.

Reduced Rule Complexity

To provide better health protection and more effective rule implementation, the EPA evaluated options for utilities to address lead contamination at lower levels and improve sampling methods. Additionally, the EPA is finalizing revisions to the 2021 LCRR to reduce complexity of the lead AL and TL construct as well as to ensure the final rule is easily understandable and requires appropriate and feasible corrective actions.

The 2021 LCRR review identified a possible revision to eliminate the lead TL and lower the AL, which the EPA is finalizing with the LCRI. Most SERs stated that the lead TL should be removed to reduce rule complexity; however, one SER advocated for retaining the TL, noting that it could be beneficial to have a warning prior to an action level exceedance (ALE). The Panel recommended that the EPA consider removing the TL.

The Panel noted that the EPA has committed to evaluating lower ALs to increase public health protection and the impacts that such a change will have on smaller systems, even though many of the

SERs expressed concern about the impact such a change would have. The Panel recommended that, if the EPA determines that a lower AL is required, the EPA provide additional time for small systems to comply with AL requirements from the 2021 LCRR that are revised by the final LCRI, including additional time for planning for the lower AL. The Panel recommended that the EPA also consider the appropriate level of public education requirements following an ALE for small systems. The Panel further recommended that the EPA consider additional flexibilities and compliance assistance for small entities serving isolated or primary non-English language-speaking communities. The Panel also recommended that the EPA issue guidance on the LCRI, including sampling, on the same date as the date of publication of the final rule (or as soon as possible after that date) to ensure the maximum time available for training and transition.

Small System Flexibility

The EPA is also finalizing additional changes to improve public health protection and improve rule implementation to ensure that the LCRI prevents adverse health effects of lead to the extent feasible. Specifically, the EPA stated in the LCRR review that the agency could make improvements to the 2021 LCRR small system flexibility. The SERs discussed the small system flexibility compliance option of installing, maintaining, and monitoring point-of-use (POU) devices. A SER noted that POU devices are helpful for non-transient non-community water systems (NTNCWSs) and very small community water systems (CWSs) due to implementation concerns; in addition, water systems are also experiencing challenges obtaining certified pitcher filters, and the SER wondered how that might affect noncompliance. Another SER noted that systems serving between 3,301 and 10,000 people typically choose optimal corrosion control treatment after an ALE instead of the other available compliance options. A different SER mentioned a study on the cost of POU filters and bottled water. The Panel recommended that the EPA request comment on additional flexibilities for small water systems to effectively reduce drinking water lead exposure and whether the EPA should allow these methods as compliance alternatives as part of the small systems flexibilities. The Panel recommended that the EPA should review the costs and availability of compliant POU or point-of-entry devices to ensure that the flexibility remains available to small systems that want to use it.

For additional information on the recommendations the EPA received, see the SBAR Panel report available at https://www.epa.gov/reg-flex/potential-sbar-panel-national-primary-drinking-water-regulation-lead-and-copper-rule and in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

7.4.3 Number and Description of Small Entities Affected

The EPA used Safe Drinking Water Information System/Federal Version (SDWIS/Fed) data from the fourth quarter 2020[210] to identify 62,518 small PWSs that may be impacted by the final LCRI. A small PWS serves 10,000 or fewer people. These water systems include 45,139 CWSs that serve year-round residents and 17,379 NTNCWSs that serve the same persons over six months per year (*e.g.*, a PWS that is an office park or school). Additional information on the characteristics of these small drinking water

[210] See Chapter 3, Section 3.2.1 of this document for a description of SDWIS/Fed. Section 3.2.1.1 provides information on how systems are classified in SDWIS/Fed including by size category. Section 3.2.1.2 discusses Lead and Copper Rule-specific data available in SDWIS/Fed including 90th percentile tap sampling data, violations, and compliance milestones. Section 3.2.1.3 discusses the CCT treatment information available in SDWIS/Fed and Section 3.2.1.4 outlines the programmatic review process for SDWIS/Fed data verification.

systems along with a discussion of uncertainty in the dataset used to derive the estimated number of small systems impacted by the final LCRI can be found in Chapter 3, Section 3.3.1. Specifically, Exhibit 3-2 and Exhibit 3-3 provide information on the inventory of small CWSs and NTNCWSs, respectively, by source water type and by refined size categories including systems serving: 100 or fewer people, 101-500 people, 501-1,000 people, 1,001-3,300 people, and 3,301-10,000 people. Of the total number of small systems serving 10,000 or fewer people, 22,235 CWSs and 434 NTNCWSs are estimated to have service lines with lead content or unknown/potential lead content. See Exhibit 3-10 and Exhibit 3-22 for additional detail on the projected number of small CWSs and NTNCWSs, respectively, with lead content service lines by the refined small system size categories. Also note that the EPA has estimated low and high scenario percent of systems, including small systems, that will exceed the lead tap sample 90th percentile final AL of 0.010 mg/L. Exhibit 4-4, in Chapter 4, Section 4.2.2.1, provides the estimated percent of systems over the final AL. The low scenario estimates for systems exceeding the final lead AL ranges from 4.4 to 21.0 percent depending on a system's LSL status (*i.e.*, the presence or absence of LSLs). The high scenario estimated percent of systems projected to be above the final lead AL ranges from 8.7 to 38.9 percent depending on the system's LSL status.

7.4.4 Description of the Compliance Requirements of the Rule

For a description of the general regulatory requirements under the final LCRI see Chapter 1, Section 1.1 and the *Federal Register* Notice (FRN) for this final rule (USEPA, 2024).

Of particular importance to small entities is the flexibility for CWSs serving 3,300 or fewer people and all NTNCWSs provided in the final LCRI to select the compliance options that best protects public health, recognizing the unique nature of these systems. This flexibility applies to CWSs serving 3,300 or fewer people and all NTNCWSs that exceed the final lead AL of 0.010 mg/L. Compliance options for these systems after an ALE include the evaluation of CCT for installation or re-optimization. In lieu of CCT requirements to address lead, with State approval, systems may also choose: (1) provision and maintenance of POU devices or (2) replacement all lead-bearing plumbing materials. A CWS serving 3,300 or fewer people or any NTNCWS that exceeds the AL must select a compliance option and submit a recommendation to the State for approval within six months from the end of the tap sampling monitoring period in which it exceeded the AL. The State has six months to approve the recommendation or designate an alternative approach. If the system has a subsequent ALE, it must implement the compliance option selected and approved by the State.

Reporting and recordkeeping requirements associated with the final LCRI are discussed under the PRA in Section 7.3, which requires that all reporting and recordkeeping requirements have practical utility and appropriately balance the needs of the government with the burden on the public. The agency has assessed the need for revisions to reporting and recordkeeping requirements and has considered them in the estimation of the burden and benefits of the final rule changes.

The final LCRI includes requirements for: conducting an service line inventory, which include lead connectors, that is updated annually; requiring mandatory full service line replacement; improving tap sampling; installing or re-optimizing CCT when water quality declines; enhancing water quality parameter monitoring; a Distribution System and Site Assessment provision to evaluate and remediate elevated lead at a site where the tap sample exceeds the lead AL; utilizing pitcher filters and POU devices; and improving customer education and outreach. These final rule requirements include

reporting and recordkeeping requirements. States are required to implement operator certification (and recertification) programs per SDWA section 1419 to ensure operators of CWSs and NTNCWSs, including small water system operators, have the appropriate level of certification to complete the required task, including the recordkeeping requirements, for the final LCRI.

7.4.5 Costs and Benefits of the Final LCRI by Small System Size Category

The EPA estimated the incremental costs and benefits, as well as the incremental net benefits of the final LCRI by PWS size category for small systems. As shown in Exhibit 7-3, the incremental benefits exceed the incremental costs of the final LCRI for most PWS size categories. There is one exception for the smallest PWSs serving 100 or fewer people: the incremental costs of the rule exceed the benefits.

Exhibit 7-3: Estimated Incremental Costs and Benefits of the Final LCRI by Small System Size Category – 2 Percent Discount Rate (millions of 2022 USD)

PWS Population Served	Metric	Low Scenario	High Scenario
25 -100	Total Annual Costs	$41.9	$43.2
	Total Annual Benefits	$18.8	$28.4
	Net Benefits	-$23.1	-$14.8
101-500	Total Annual Costs	$55.6	$58.1
	Total Annual Benefits	$76.3	$135.3
	Net Benefits	$20.7	$77.3
501-1,000	Total Annual Costs	$23.7	$25.3
	Total Annual Benefits	$65.1	$113.7
	Net Benefits	$41.3	$88.5
1,001-3,300	Total Annual Costs	$45.6	$50.4
	Total Annual Benefits	$200.4	$354.5
	Net Benefits	$154.8	$304.1
3,301-10,000	Total Annual Costs	$110.0	$135.8
	Total Annual Benefits	$1,063.1	$1,845.3
	Net Benefits	$953.1	$1,709.4

Acronyms: PWS = public water system.

7.4.6 Analysis of Alternative Small System Rule Requirements

The EPA considered two options that would mitigate the economic impact of the final LCRI on small entities. The options differed by the size threshold at which CWSs could take advantage of the compliance flexibilities. The selected option, in the final LCRI, includes flexibility for CWSs that serve 3,300 or fewer people, and all NTNCWSs. If these water systems have a lead 90th percentile above the AL, they can choose from the following three options, following State approval, to reduce the concentration of lead in their water:

1. Optimize existing CCT or install new CCT.

2. Install and maintain POU devices at all locations being served.
3. Replace all lead-bearing plumbing materials in the system.[211]

To estimate the economic impact on small entities, the EPA's cost model applies the least-cost compliance option to all model PWSs that exceed the AL. To determine the least-cost compliance option, the cost of each alternative is computed across each representative model PWS in the cost model based on its assigned characteristics including: the presence of CCT, the cost and effectiveness of CCT, the starting water quality parameters, monitoring requirements, the number of entry points, the unit cost of POU, and the number of households served. For an expanded discussion on the assignment of system characteristics, see Chapter 4. These characteristics are the primary drivers in determining the costs once a water system has been triggered into CCT installation or re-optimization or POU requirements. The model estimates the net present value for implementing each compliance option and selects the least-cost alternative to retain in the summarized final rule costs.

The EPA estimated low- and high-cost scenarios to characterize uncertainty in the cost model results. These scenarios are functions of assigning different (low and high) input values to a number of variables that affect the relative cost of the small system compliance options (see Chapter 4, Section 4.2.2 for additional information on uncertain variable value assignment). Therefore, the selection of a compliance option is different across the low- and high-cost scenarios.

The number of systems serving under 3,300 people that choose to install and maintain POUs under the final LCRI range from 2,406 to 4,066. These PWS serve a total of between 250,048 and 474,266 people.

A second form of flexibility provided to all PWSs impacted by the rule, but that is most likely to benefit small PWSs, is the ability for systems with ALEs to choose to replace all of their lead and GRR service lines in five years or less and avoid the expense of having to conduct a pipe loop study prior to installing or reoptimizing CCT. Systems choosing this option must replace at least 20 percent of lead and GRR service lines annually and at the end of the five years, have no lead, GRR, or unknown service lines remaining in their inventory. For systems with approximately 50 LSL or fewer, most or all the lines can be replaced for the cost of the pipe rig study. These systems instead would be able to conduct a much less expensive coupon study if needed after the mandatory service line replacement program has been completed within five years or less.

In the case of the regulatory flexibility analysis, the EPA limited the assessment to small CWSs since small NTNCWSs operate in numerous industries and the EPA does not have information on NTNCWSs revenue. The EPA's decision to limit its regulatory flexibility analysis to CWSs is supported by the EPA's *Assessment of the Vulnerability of Noncommunity Water Systems to SDWA Cost Increases* (2008). In this study, the EPA examined the burden of SDWA rule costs in comparison to the average revenues of various categories of NTNCWSs. All of the NTNCWS categories reviewed were found to be less vulnerable to SDWA-related increases than a typical CWS. The report notes that, in some categories of businesses, costs are more easily passed on to the customer base than in others. However, in each NTNCWS category, expenditures on water were found to be a relatively small percentage of total

[211] The EPA could not evaluate the cost of removing lead-bearing plumbing components from small systems, but the agency notes that, if a system should select this option, it would likely be considered the lowest cost alternative of the compliance options. Therefore, since the EPA has not included this option in its cost modeling, the agency's small system compliance costs may be overestimated.

revenues. Water expenditures (including expenditures for sewer service and miscellaneous other utilities) totaled less than 1 percent of total revenues in nearly all cases and were not more than 1.3 percent of total revenues for any category. Several caveats were put forth in this report, including one that considered the potential for underestimating the impact to golf courses, which were grouped in with other recreational entities whose use of water was less significant to the core business than the golf courses. Despite the significant caveats listed, the report strongly suggests that NTNCWSs should not be considered particularly vulnerable to operating cost increases resulting from SDWA rulemakings.

The EPA calculated the annual revenue per CWS by using each PWS's average daily flow and the average revenue per thousand gallons delivered from the Community Water System Survey (CWSS) (USEPA, 2009, Table 61). These revenue estimates were then inflated to 2022 dollars using the consumer price index (CPI) for utilities.

Exhibit 7-4 and Exhibit 7-5 provide the estimated total number of small CWSs, by system size and source water type, which have incremental annual costs that exceed the 1 percent and 3 percent of annual revenue threshold values under the low- and high-cost scenarios. Under the final LCRI, the number of small CWSs that will experience incremental annual costs of more than 1 percent of revenues ranges from 35,895 to 37,069 (80 percent to 82 percent of all small CWSs) and the number of small CWSs that will have annual incremental costs exceeding 3 percent of revenues ranges from 26,993 to 27,568 (60 percent to 61 percent of small CWSs).

Exhibit 7-4: Estimated Incremental Costs vs. Revenue for Small CWSs – Low Scenario*

Category	Source Water	Size Category	Number of CWSs	Number of CWSs with Cost Revenue Ratio > 1%	Number of CWSs with Cost Revenue Ratio > 3%	Percent of CWSs with Cost Revenue Ratio > 1%	Percent of CWSs with Cost Revenue Ratio > 3%
Private	Ground	≤100	9,400	9,341	9,309	99%	99%
Private	Ground	101 to 500	8,190	7,842	6,699	96%	82%
Private	Ground	501 to 1,000	1,299	826	318	64%	24%
Private	Ground	1,001 to 3,300	1014	493	147	49%	14%
Private	Ground	3,301 to 10,000	336	179	120	53%	36%
Private	Surface	≤100	404	400	398	99%	99%
Private	Surface	101 to 500	769	737	544	96%	71%
Private	Surface	501 to 1,000	232	133	41	57%	18%
Private	Surface	1,001 to 3,300	272	100	25	37%	9%
Private	Surface	3,301 to 10,000	182	100	64	55%	35%
Public	Ground	≤100	1,409	1,404	1392	100%	99%
Public	Ground	101 to 500	4,838	4,705	3452	97%	71%
Public	Ground	501 to 1,000	2,869	2216	813	77%	28%
Public	Ground	1,001 to 3,300	4,488	2536	775	57%	17%
Public	Ground	3,301 to 10,000	2,459	1434	1011	58%	41%
Public	Surface	≤100	518	516	510	100%	98%
Public	Surface	101 to 500	1,287	1245	776	97%	60%
Public	Surface	501 to 1,000	930	673	192	72%	21%
Public	Surface	1,001 to 3,300	2,193	1019	253	46%	12%
Public	Surface	3,301 to 10,000	2,049	1170	729	57%	36%
Total			**45,138**	**37,069**	**27,568**	**82%**	**61%**

Acronyms: CWS = community water system.

Notes

* When evaluating the economic impacts on PWSs, the EPA uses the estimated PWS cost of capital to discount future costs (not the 2 percent discount rate used to evaluate social costs and benefit), as this best represents the actual costs of compliance that water systems would incur over time. For more information on cost of capital see Chapter 4, Section 4.2.3.3.

Exhibit 7-5: Estimated Incremental Costs vs. Revenue for Small CWSs – High Scenario*

Category	Source Water	Size Category	Number of CWSs	Number of CWSs with Cost Revenue Ratio > 1%	Number of CWSs with Cost Revenue Ratio > 3%	Percent of CWSs with Cost Revenue Ratio > 1%	Percent of CWSs with Cost Revenue Ratio > 3%
Private	Ground	≤100	9,400	9,281	9,222	99%	98%
Private	Ground	101 to 500	8,190	7,387	6,192	90%	76%
Private	Ground	501 to 1,000	1,299	806	333	62%	26%
Private	Ground	1,001 to 3,300	1014	478	154	47%	15%
Private	Ground	3,301 to 10,000	336	177	131	53%	39%
Private	Surface	≤100	404	397	391	98%	97%
Private	Surface	101 to 500	769	692	490	90%	64%
Private	Surface	501 to 1,000	232	124	44	53%	19%
Private	Surface	1,001 to 3,300	272	105	30	39%	11%
Private	Surface	3,301 to 10,000	182	102	69	56%	38%
Public	Ground	≤100	1,409	1,393	1376	99%	98%
Public	Ground	101 to 500	4,838	4,544	3226	94%	67%
Public	Ground	501 to 1,000	2,869	2171	862	76%	30%
Public	Ground	1,001 to 3,300	4,488	2396	866	53%	19%
Public	Ground	3,301 to 10,000	2,459	1377	1051	56%	43%
Public	Surface	≤100	518	512	499	99%	96%
Public	Surface	101 to 500	1,287	1190	727	92%	56%
Public	Surface	501 to 1,000	930	630	209	68%	22%
Public	Surface	1,001 to 3,300	2,193	976	278	45%	13%
Public	Surface	3,301 to 10,000	2,049	1157	843	56%	41%
Total			**45,138**	**35,895**	**26,993**	**80%**	**60%**

Acronyms: CWS = community water system.
Notes
* When evaluating the economic impacts on PWSs, the EPA uses the estimated PWS cost of capital to discount future costs (not the 2 percent discount rate used to evaluate social costs and benefit), as this best represents the actual costs of compliance that water systems would incur over time. For more information on cost of capital see Chapter 4, Section 4.2.3.3.

7.4.6.1 Alternative Small System Flexibility Option

The EPA assessed, but did not select, a second small system flexibility option. Like the selected final LCRI small system flexibility option this alternative option would have mitigated the economic impact of an ALE on small entities by allowing the PWSs to choose between (1) optimizing existing CCT or installing new CCT or (2) installing and maintaining POU devices at all locations being served.[212] This second small system flexibility option would be available to all NTNCWSs and CWSs serving up to 10,000 people. This option differs from the final LCRI requirements, which allow CWSs serving up to 3,300 people the choice between the two compliance alternatives, by increasing the CWS size threshold so that systems serving up to 10,000 people would have the ability to choose between the two regulatory compliance alternatives. Under this alternative option, the EPA estimates that no additional CWSs serving between 3,301 to 10,000 people will elect to install and maintain POU devices.[213]

See Chapter 8, Section 8.8, for the estimated monetized annualized total costs and benefits of this alternative size threshold (CWSs serving 10,000 or fewer people) compared with the final LCRI with the small CWS threshold of 3,300 or fewer people.

7.5 Unfunded Mandates Reform Act

The UMRA (1995) seeks to protect State, local, and tribal governments from the imposition of unfunded federal mandates. In addition, the Act seeks to strengthen the partnership among the federal government and State, local, and Tribal governments.

Title II of UMRA establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and Tribal governments and the private sector. Under section 202 of UMRA, the EPA must prepare a written statement, including a cost-benefit analysis, for rules with “federal mandates” that may result in expenditures by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year, adjusted for inflation. The EPA has calculated the cost of the rule in 2022 dollars, therefore, the UMRA requirements are triggered if expenditures exceed $174 million in any one year.

Section 205 of UMRA requires the EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome option that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows the EPA to adopt an alternative other than the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the rule an explanation why that alternative was not adopted. The EPA’s analysis of alternative regulatory options, presented in Chapter 8, is provided in Exhibit 7-6.

[212] Refer to footnote 211 regarding the lead-bearing compliance alternative.
[213] Note that actual model estimates provide for fractional system implementation. The model predicts that fewer than 0.5 systems implement POU treatment, based on the modeling assumption of cost minimization, resulting in a rounded number of zero systems implementing POU in the 3,301 to 10,000 system size category.

Exhibit 7-6: Summary of Alternative Other Options Considered for the Final LCRI

Alternative Option Considered	Difference in Annual Net Benefits of Alternative vs. Final Rule (High Scenario, 2% Discount Rate, million 2022 Dollars)	EPA Reason(s) for Not Adopting Alternative
Lead Action Level:		
Lead AL of ≤0.015 mg/L	-$1,289.6	Lower net benefits driven mostly by lower health benefits.
Lead AL of ≤0.005 mg/L	$2,325.3	The EPA is concerned with the technical feasibility of PWS achieving an AL below 0.010 mg/L
Service Line Replacement Rate:		
Service lines are replaced at an annual rate of 7%.	-$3,190.8	Lower net benefits driven mostly by lower health benefits.
Definition of Lead Content to be Replaced:		
Systems must replace lead service lines and galvanized lines previously downstream of lead lines or unknown lead content lines, and lead connectors and galvanized lines previously downstream of lead connectors.	$5,331.9	The EPA concerned about how these activities might pull resources away from the removal of lead and GRR service lines that pose a greater exposure risk. Also, due to very limited data on the reduction in lead concentration associated with removing lead connectors, the EPA used the same concentration reductions seen with partial SLR. This likely significantly overestimates the benefits of replacing lead connectors and makes the benefits associated with lead connectors highly uncertain.
SLR Deferred Deadline:		
Systems may be given a deferred deadline for finishing all LSL and GRR replacements resulting in a maximum rate which is the lower of 10,000 lines per year or 39 replacements per 1000 connections per year (proposed rule– with change to connections per year from households per year).	-$8.3	Lower net benefits driven mostly by delay in providing health benefits.
Systems may be given a deferred deadline for finishing all LSL and GRR replacements resulting in a maximum rate which is the lower of 8,000 lines per year or 39 replacements per 1000 connections per year.	-$65.0	Lower net benefits driven mostly by delay in providing health benefits.
Lead Tap Sampling:		
All systems return to standard 6-month	Very little	The EPA's monetized cost and benefit

Alternative Option Considered	Difference in Annual Net Benefits of Alternative vs. Final Rule (High Scenario, 2% Discount Rate, million 2022 Dollars)	EPA Reason(s) for Not Adopting Alternative
monitoring with an ALE. Systems with lead, GRR, and/or unknown service lines at the compliance date conduct standard 6-month monitoring at the compliance date and non-lead service line systems remain on LCR monitoring schedule until new LCRI protocol sampling may change P90. When (& if) a non-lead system finds an LSL/GRR they return to 6-month monitoring. (proposed rule). Systems that sampled using the new protocol and are below the LCRI AL prior to the compliance date may qualify to retain their current schedule.	difference in modelled costs and benefits	estimates were too close to conclusively determine if the alternative option or the final LCRI has greater net benefits. The EPA is concerned about the potentially high volume of systems required to start standard monitoring (especially small systems), and the States' ability to handle the increased demands. The EPA considered a phased approach but decided that the complexity of a phased approach was not commensurate with the benefits.
Multiple ALE Filter Programs:		
Systems with at least 2 lead ALEs in a rolling 5-year period must prepare and submit a filter plan to State. Systems with at least 3 lead ALEs in a rolling 5-year period must make filters available to all customers with lead, GRR, and unknown lead content service lines.	The annual cost of this option is $27.5 million lower than the final rule. Benefits are likely to be the same as the rule.	The EPA selected the final LCRI multiple ALE option because it protects individuals in systems with multiple ALEs that do not have lead, GRR, or unknown service lines. The monetized costs and benefit could not be used in this case given a number of known uncertainties. The EPA notes that the estimated benefits of the LCRI in this case are underestimated (given the model does not account for benefits at non-lead and GRR service line locations). Costs are also likely overestimated for both the alternative option and the final LCRI, given an assumption of a 100% filter pick-up rate. Because more households are covered under the LCRI costs the cost overestimate is greater for the final rule.
Systems with at least 2 lead ALEs in a rolling 5-year period must prepare and submit a filter plan to State. Systems with at least 3 lead ALEs in a rolling 5-year period must deliver temporary filters directly to all customers.	-$5.8	The EPA has feasibility concerns with this option given the possible economic and logistical challenges for systems. Also note that lower net benefits are driven by higher costs.
Small System Flexibility:		

Alternative Option Considered	Difference in Annual Net Benefits of Alternative vs. Final Rule (High Scenario, 2% Discount Rate, million 2022 Dollars)	EPA Reason(s) for Not Adopting Alternative
CWSs that serve 10,000 or fewer people, and all NTNCWSs, are provided compliance flexibility when they exceed the AL.	$1.1	The EPA finds that the complexity of implementing point-of-use filtration at all residences in a system serving 3,300 to 10,000 individuals, or potentially 1,300 to 4,000 separate locations, cannot be correctly captured in the estimated cost structure within the economic model and makes this option infeasible.

Acronyms: AL = action level; ALE = action level exceedance; CCT = corrosion control treatment; CWS = community water system; GRR = galvanized requiring replacement; LCRI = Lead and Copper Rule Improvements; LSL = lead service line; NTNCWS = non-transient, non-community water system; P90 = 90th percentile lead level; POU = point-of-use; PWS = public water system; SLR = service line replacement.

Before the EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of the EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

The final LCRI does contain a federal mandate that may result in expenditures to State, local, and Tribal governments, in the aggregate, or to the private sector, of $174 million or more in any one year. Under the low scenario, the highest annual incremental cost over the 35-year period of analysis is estimated to happen in 2027. In 2027, publicly owned PWSs are expected to have undiscounted incremental costs of $3.8 billion, privately owned PWSs are expected to have undiscounted incremental costs of $700 million, and States will have undiscounted incremental costs of $119 million. Under the high scenario, the highest annual incremental cost over the 35-year period of analysis is estimated to happen in 2031. In 2031, publicly owned PWSs are expected to have undiscounted incremental costs of $5.9 billion, privately owned PWSs are expected to have undiscounted incremental costs of $875 million, and States will have undiscounted incremental costs of $40 million. Therefore, the final LCRI is subject to the requirements of sections 202 and 205 of UMRA. The EPA notes that the Federal government is providing potential sources of funding to offset some of those direct compliance costs of the LCRI, including $15 billion as part of the BIL. However, the final rule’s costs still exceed $174 million for a given year even when considering currently available Federal funds.

The annualized incremental costs and benefits of the final LCRI, that are borne by public, private and Tribal PWSs under the low and high scenarios are provided in Exhibit 7-7, and Exhibit 7-8 provides the same information for small PWSs (10,000 or fewer people).[214]

As these exhibits show, public entities bare the vast majority of the costs, and their customers accrue most of the benefits, of the final LCRI. In addition to these PWS costs, as discussed in Chapter 4 under the final LCRI, States will incur annualized incremental administrative costs of $25.8 million to $27.7 million (2 percent discount rate). Finally, wastewater treatment plants, most of which are publicly owned, will incur an incremental annualized cost of between $0.1 million and $0.3 million (2 percent discount rate).

Exhibit 7-7: Estimated Total Annualized Incremental Costs and Benefits at 2 Percent Discount Rate (millions of 2022 Dollars)

Type of System	Low Scenario	High Scenario
Public PWS Incremental Annualized Costs	$1,239.2	$1,690.2
Private PWS Incremental Annualized Costs	$206.3	$260.6
Tribal PWS Incremental Annualized Costs	$5.9	$7.2
Public PWS Incremental Annualized Benefits	$11,997.2	$22,386.3
Private PWS Incremental Annualized Benefits	$1,454.3	$2,680.0
Tribal PWS Incremental Annualized Benefits	$42.0	$76.4

Acronyms: PWS = public water system.
Note: Public systems include public-private partnerships. In addition, for the UMRA analysis, Federally owned systems are excluded from the public costs.

Exhibit 7-8: Estimated Total Annualized Incremental Costs and Benefits for Small PWSs (≤ 10,000 people) at 2 Percent Discount Rate (millions of 2022 Dollars)

Type of System	Low Scenario	High Scenario
Small Public PWS Incremental Annualized Costs	$169.7	$202.2
Small Private PWS Incremental Annualized Costs	$81.1	$88.2
Small Tribal PWS Incremental Annualized Costs	$3.8	$4.3
Small Public PWS Incremental Annualized Benefits	$1,173.0	$2,045.9
Small Private PWS Incremental Annualized Benefits	$231.2	$397.5
Small Tribal PWS Incremental Annualized Benefits	$19.5	$33.9

Acronyms: PWS = public water system.
Note: Public systems include public-private partnerships. In addition, for the UMRA analysis, Federally owned systems are excluded from the public costs.

7.6 Executive Order 13132: Federalism

Executive Order 13132, *Federalism* (64 FR 43255, August 10, 1999), requires the EPA to develop an accountable process to ensure “meaningful and timely input by state and local officials in the development of regulatory policies that have federalism implications.” “Policies that have federalism

[214] For the UMRA analysis, a small PWS is defined as one that serves 10,000 or fewer people.

implications" are defined in the Executive Order to include regulations that have "substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government."

This action has federalism implications due to the substantial direct compliance costs on State or local governments. The net change in regulatory implementation and oversite related cost to State, local, and tribal governments in the aggregate is estimated to be between $25.8 and $27.7 million, in 2022 dollars, at a 2 percent discount rate. However, the EPA notes that the federal government is providing a potential source of funds to offset some of those direct compliance costs through the BIL.

To fulfill requirements of Executive Order 13132 section 6 (and UMRA), the EPA held a Federalism consultation on October 13, 2022, with 15 organizations. These organizations representing State and local governments had significant experience with intergovernmental relationships as well as expertise in drinking water. [215] During the meeting, the EPA presented background information and questions for feedback on key areas of the final rule. The EPA specifically requested input on the following key rule areas: achieving 100 percent LSLR, tap sampling and compliance, reducing rule complexity, and small system flexibility. During the 60-day public comment period which followed the October 13, 2022 meeting, the EPA provided the members of the organizations present at the meeting, and those contacted through the EPA Federalism consultation notification letter sent directly to State and local government officials, the opportunity to provide input at requested follow-up Federalism meetings and/or to the EPA docket. The EPA received requests for additional meetings and held meetings with the Association of State Drinking Water Administrators and member States on October 5, 2022 and November 2, 2022. A summary report of the views expressed during the Federalism consultation meeting and in written submissions is available in the docket at EPA-HQ-OW-2022-0813 at www.regulations.gov.

7.7 Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (65 FR 67249, November 9, 2000), requires the EPA to develop an accountable process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications." The Executive Order defines "policies that have tribal implications to include regulations that have "substantial direct effects on one or more Indian tribes, on the relationship between the federal

[215] Specifically, the EPA invited the following national organizations to the Federalism meeting: the National Governor's Association, the National Conference of State Legislatures, the Council of State Governments, the National League of Cities, the U.S. Conference of Mayors, the National Association of Counties, the International City/County Management Association, the National Association of Towns and Townships, the Council of State Governments, County Executives of America, and the Environmental Council of the States. The EPA also invited the Association of State Drinking Water Administrators, the Association of Metropolitan Water Agencies, the National Rural Water Association, the American Water Works Association, the Association of State and Territorial Health Officials, the National Association of County and City Health Officials, the American Public Works Association, the Association of Clean Water Administrators, the Western States Water Council, the African American Mayors Association, the National Association of State Attorneys General, the Western Governors' Association, the National School Board Association, the American Association of School Administrators, and the Council of the Great City Schools to participate in the meeting.

government and the Indian tribes, or on the distribution of power and responsibilities between the federal government and Indian tribes."

The final LCRI has tribal implications since it may impose substantial direct compliance costs on Tribal governments, and the federal government will not provide the funds necessary to pay those costs. There are 996 PWSs serving tribal communities, 87 of which are federally owned. This EA of the final LCRI requirements estimated that the total annualized incremental costs placed on all systems serving tribal communities ranges from $5.9 – $7.2million. The EPA notes that these estimated impacts will not fall evenly across all Tribal systems. The final LCRI does offer regulatory relief by providing flexibility for CWSs serving 3,300 or fewer people and all NTNCWSs to choose CCT, POU devices, and replacement of lead-bearing materials to address lead in drinking water. This flexibility may result in LCRI implementation cost savings for many tribal systems since 89 percent of tribal CWSs serve 3,300 or fewer people and 16 percent of all tribal systems are NTNCWSs.

Consistent with the EPA Policy on Consultation and Coordination with Indian Tribes (May 4, 2011), the EPA consulted with Tribal officials during the development of this action to gain an understanding of Tribal views about potential revisions to key areas of the 2021 LCRR. Between October 6, 2022 and December 9, 2022, the EPA consulted with tribal officials from federally recognized Indian Tribes through the EPA's American Indian Environmental Office. The consultation included two webinars with interested Tribes on October 27, 2022 and November 9, 2022, where the EPA provided an overview of rulemaking information and requested input. The EPA requested input on four specific areas: achieving 100 percent LSLR, tap sampling and compliance, reducing rule complexity, and small system flexibility. A total of 11 Tribal representatives participated in the two webinars. Webinar participants provided verbal comments, but the EPA did not receive any written consultation comments from Tribal organizations during the 60 -day comment period that followed the webinars. A summary report of the views expressed during Tribal consultations is available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov.

7.8 Executive Order 13045: Protection of Children from Environmental Health and Safety Risks

Executive Order 13045, Protection of Children from Environmental Health and Safety Risks (62 FR 19885, April 23, 1997), applies to any rule initiated after April 21, 1998, that 1) is determined to be "economically significant" as defined under Executive Order 12866; and 2) concerns an environmental, health, or safety risk that the EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, the EPA must evaluate the environmental, health, or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible options considered by the EPA.

The final LCRI is subject to Executive Order 13045 because it is economically significant as defined in Executive Order 12866, and based on the record, the EPA finds that the environmental health or safety risk addressed by this final action would have a disproportionate effect on children. Additionally, the agency's 2021 Policy on Children's Health (https://www.epa.gov/children/epas-policy-evaluating-risk-children) is to protect children from environmental exposures by consistently and explicitly considering early life exposures (from conception, infancy, early childhood, and through adolescence) and lifelong

health in all human health decisions through identifying and integrating data when conducting risk assessments of children's health.

This action's health and risk assessments are contained in Chapter 5 and the associated Appendices D, E, and F. The EPA expects that the final LCRI will provide additional protection to both children and adults who consume drinking water supplied by systems. The EPA also finds that the benefits of the final LCRI, including reduced health risk, will provide significant benefits to infants and young children due to reducing exposure to lead in drinking water. This is due to the fact that developing fetuses, infants, and young children are at higher risk for the adverse neurodevelopmental effects of lead than adolescents or adults. These effects include, but are not limited to, decreases in cognitive function, as summarized in Appendix D. This increased susceptibility is due to several factors, related to both physiology and levels of exposure to lead during childhood. Physiological differences in neurodevelopment suggest that infants and young children are at higher risk due to the susceptibility of the developing brain. Additionally, there are physiological differences in lead absorption: given the same level of lead exposure, infants, and young children will absorb more lead from the gastrointestinal tract than older children or adults. Finally, there is also epidemiological evidence demonstrating that there are higher lead exposures in infants and young children relative to older children or adults, which are attributable to differences in behavior and diet.

It is important to note that the greater susceptibility in infants and young children does not minimize the risks of lead exposures in adolescents or adults. Lead is associated with numerous adverse health effects in these populations as well, including cardiovascular effects, immune system effects, and reproductive and developmental effects which are also summarized in Appendix D. In addition, lead stored in the bones of women from prior exposures can be mobilized from bone during pregnancy, leading to subsequent increases in prenatal and postnatal lead exposures in children (via transfer from the placenta and from breastmilk, respectively) (USEPA, 2013). It follows then that reductions in exposure to women even prior to pregnancy will result in further protections for infants and children due to decreases in exposure during pregnancy. For these reasons, lead exposures throughout the lifespan are of concern to human health, and the developing fetus, infant and young children are the most susceptible. Reducing lead exposures in drinking water will protect children from this increased risk.

See Chapter 6, where the EPA evaluated the environmental health or safety effects of lead found in drinking water on children and estimated the risk reduction and health endpoint impacts to children associated with the final LCRI requirements that reduce lead in drinking water including the installation and re-optimization of CCT and the replacement of lead and GRR service lines.

7.9 Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

Executive Order 13211, *Actions Concerning Regulations That Significantly Affect Energy Supply Distribution, or Use* (66 FR 28355, May 22, 2001), provides that agencies shall prepare and submit to the Administrator of the OIRA, OMB, a Statement of Energy Effects for certain actions identified as "significant energy actions." Section 4(b) of Executive Order 13211 defines "significant energy actions" as "any action by an agency (normally published in the *Federal Register*) that promulgates or is expected to lead to the promulgation of a final rule or regulation, including notices of inquiry, advance notices of final rulemaking, and notices of final rulemaking: (1)(i) that is a significant regulatory action under

Executive Order 12866 or any successor order, and (ii) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (2) that is designated by the Administrator of the Office of Information and Regulatory Affairs as a significant energy action."

The final LCRI is not a "significant energy action" as defined in Executive Order 13211. This rule is a significant regulatory action under Executive Order 12866 (see Section 7.2); however, it is not likely to have a significant adverse effect on the supply, distribution, or use of energy, for the reasons described as follows.

7.9.1 Energy Supply

The final LCRI does not regulate power generation, either directly or indirectly, and public and private drinking water systems subject to the final LCRI do not, as a general rule, generate power. Further, the energy cost increases borne by customers of systems as a result of the final LCRI is a low percentage of the total cost of water. Therefore, power generation utilities that purchase water as part of their operations are unlikely to face any significant effects as a result of the final LCRI.

7.9.2 Energy Distribution

The final LCRI does not regulate any aspect of energy distribution and drinking water systems that are regulated by the final LCRI already have electrical service. The rule is not expected to increase peak electricity demand at systems. Therefore, the EPA assumes that the existing connections are adequate and that the final LCRI has no discernible adverse effect on energy distribution.

7.9.3 Energy Use

The EPA has determined that the incremental energy used to implement CCT at drinking water systems in response to the final regulatory requirements is minimal. Therefore, the EPA does not expect any noticeable effect at the national level on power generation in terms of average and peak loads.

7.10 National Technology Transfer and Advancement Act (NTTAA)

Section 12(d) of the NTTAA of 1995 directs the EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (*e.g.*, materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs the EPA to provide Congress, through OMB, explanations when the EPA decides not to use available and applicable voluntary consensus standards.

The final LCRI may involve existing voluntary consensus standards in that it requires additional monitoring for lead and copper. Monitoring and sample analysis methodologies are often based on voluntary consensus standards. However, the final LCRI does not change any methodological requirements for monitoring or sample analysis. The EPA's approved monitoring and sampling protocols generally include voluntary consensus standards developed by agencies such as the American National Standards Institute (ANSI) and other such bodies wherever the EPA deems these methodologies appropriate for compliance monitoring. The EPA notes that in some cases, the final LCRI revises the required frequency and number of samples taken.

7.11 Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations and Executive Order 14096 (Revitalizing Our Nation's Commitment to Environmental Justice for All)

The EPA anticipates the final LCRI will not create disproportionate and adverse human health or environmental effects on communities with environmental justice (EJ) concerns under Executive Order 14096 (88 FR 25251, April 21, 2023); see also Executive Order 12898 (59 FR 7629, February 16, 1994). The documentation for this finding, including additional details on the methodology, results, and conclusions, are included in the EPA's Environmental Justice Analysis for the Proposed Lead and Copper Rule Improvements Report (USEPA, 2023) and is available in the public docket for this action (EPA-HQ-OW-2022-0801).

Executive Order 12898 established Federal executive policy on EJ. The main provision of Executive Order 12898 directs Federal agencies, to the greatest extent practicable and permitted by law, to make achieving EJ part of their mission. Executive Order 12898 states "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions."

Executive Order 14096 directs the Federal government to build upon and strengthen its commitment to deliver EJ to all communities across America through an approach that is informed by scientific research, high-quality data, and meaningful Federal engagement with communities with EJ concerns.

Consistent with the agency's Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (USEPA, 2016), the EPA conducted an EJ analysis for the proposed LCRI to assess impacts anticipated to result from the proposed LCRI (USEPA, 2023). The analysis builds on and advances the analysis conducted under the 2021 LCRR, which evaluated baseline exposure to lead in drinking water. The proposed LCRI's EJ analysis evaluated potential EJ concerns associated with lead in drinking water in a baseline identified in the EJ analysis and the proposed LCRI, including consideration of whether potential EJ concerns are created or mitigated by the proposed LCRI relative to the baseline of the analysis. The EPA compiled recent peer-reviewed research on the relationship between lead exposure and socioeconomic status and found that Black, Indigenous, and People of Color (BIPOC) and/or low-income populations are at higher risk of lead exposure and associated health risks. The EPA also conducted an analysis of seven case study cities further described below. The EPA selected the case studies because they represented a range of system sizes and geographic regions.

Because updated service line inventories were not available for the EJ analysis conducted under the 2021 LCRR, the EPA used housing age as a proxy indicator for LSL presence in the EJ analysis for the proposed 2021 LCRR[216]. In that EJ analysis, the EPA identified some trends indicating disproportionate

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[216] Housing vintage is an indicator for risk of LSLs, lead solder, and leaded brass fixtures (Rabin, 2008). LSLs were installed through the 1980s, with decreases in the number of installations in the decades following 1930. The EPA used Integrated Public Use Microdata Series (IPUMS) dataset to link individuals

and adverse human health risk for exposure to lead in drinking water based on LSL presence in minority populations and low-income populations, and also that populations of children in minority households and/or low-income households are disproportionately at risk of exposure to lead in drinking water because they are more likely to live in housing built when LSLs were more commonly used.

Updated inventories were similarly not widely available yet; however, some water systems have published updated inventories online. In the EJ analysis for the LCRI, the EPA evaluated service line inventories from seven water systems with published inventories to estimate baseline exposure to lead in drinking water using LSL presence as a proxy for lead exposure (USEPA, 2023). The EPA found a range of outcomes with respect to the sociodemographic and housing unit variables in areas served by LSLs in the cities investigated. While the EPA found that block groups with LSLs often had higher percentages of low-income residents, renters, and people of color (specifically, Black, Hispanic, or linguistically isolated individuals) compared to block groups without LSLs, there was little evidence that the number of LSLs per capita was positively correlated with block group demographic characteristics across all seven case studies. However, block groups with the highest number of LSLs per capita (top quartile) had a notably larger percentage of Black residents than the service area as a whole for six case studies. Two other measures (traffic density and pre-1960 housing) were included to capture the possibility of other sources of lead. The analysis results showed that pre-1960 housing is notably higher in block groups with LSLs compared to those without. The percent of housing built prior to 1960, which corresponds to a higher likelihood of containing lead-based paint and LSL presence, was also positively correlated with the number of LSLs per capita for every case study and was also elevated in the top quartile compared to the service area as a whole. A separate EPA analysis also revealed that LSL prevalence in Cincinnati, OH and Grand Rapids, MI was a stronger predictor of the prevalence of elevated blood lead levels compared with the EPA's EJScreen 2017 Lead Paint EJ Index or the U.S. Department of Housing and Urban Development's Deteriorated Paint Index (Tornero-Velez et al., 2023).

Taken together, these findings support the concern that adverse health effects associated with baseline lead exposure from LSLs may be inequitably distributed based on analysis of LSL presence. While the limited number of water systems included in the analysis do not permit conclusions to be made about EJ and LSL presence outside of the context of these individual systems, the analysis does point to several findings. The analysis demonstrated significant differences in socioeconomic and housing characteristics and the prevalence of LSLs across these systems. It also demonstrated the importance of considering characteristics within the individual system context. Taken together, these findings support the concern that adverse health effects associated with lead exposure from LSLs may be inequitably distributed with respect to LSL presence.

Statistical analysis did not identify strong associations between LSLR and the characteristics of the Census block group in which they occurred (*e.g.*, socioeconomic and housing characteristics) in any of the case studies. This is because, in general, at the time of the analysis either no LSLs or relatively few LSLs have been removed in the locations of the case studies, which affects the EPA's ability to quantify a relationship with LSLR. Conversely, in the case study of the water system in Newark, New Jersey, almost all LSLs were removed in a short period of time, similarly obscuring the relationship between removals

to housing units by decennial age group beginning with housing built before 1939 and ending with housing bult after 1980.

and the socioeconomic and housing unit variables. Nevertheless, the EPA recognizes the potential that even in a water system where there are no EJ concerns with respect to LSL presence, the sequence and timing in which LSLs and GRR service lines are replaced by a system's service line replacement program can potentially create a concern. Section III.H of the preamble highlights the final LCRI provisions intended to facilitate water system planning to prevent or minimize EJ concerns from being created within the replacement program (, as well as other requirements that can make full replacements and information more accessible to all customers. In Sections III.G and III.H of the preamble, the EPA also highlights external funding available to support full service line replacement, as well as water systems' obligations under Federal Civil Rights law.

On October 25, 2022, and November 1, 2022, the EPA held public meetings related to EJ and the development of the proposed LCRI. The meetings provided an opportunity for the EPA to share information and for individuals to offer input on EJ considerations related to the development of the proposed LCRI and how to more equitably address lead in drinking water issues in their communities.

During the meetings and in subsequent written comments, the EPA received public comment on topics including disproportionate exposure to lead and its health effects among BIPOC and low-income communities; LSLR funding; methods to prioritize LSLR; access to LSLR for renters; filter distribution and use during LSLR; lowering the lead AL; establishing a maximum contaminant level (MCL) for lead; updating the lead health effects language required for public education, public notification, and the CCR; ensuring that public education and public notification reaches communities that are most at risk; first- and fifth-liter sampling; remediating lead identified through sampling in schools and child care facilities; EJ concerns with corrosion control studies; community engagement; and regulatory enforcement and oversight. For more information on the public meetings, please refer to the *Public Meeting on Environmental Justice (EJ) Considerations for the Development of the Proposed Lead and Copper Rule Improvements (LCRI) Meeting Summary* for each of the meeting dates in the public docket at https://www.regulations.gov/docket/EPA-HQ-OW-2022-0801. Written public comments can also be found in the docket. The EPA's Environmental Justice analysis is available in the public docket associated with this rulemaking Docket ID Number: EPA-HQ-OW-2022-0801 available at https://www.regulations.gov/document/EPA-HQ-OW-2022-0801-0689.

7.12 Consultations with the Science Advisory Board, National Drinking Water Advisory Council, and the Secretary of Health and Human Services

7.12.1 Consultation with Science Advisory Board

As required by section 1412(e) of SDWA, in 2022, the EPA consulted with the SAB on the key areas being considered for the proposed LCRI and tools, indicators, and measures for use in future analyses to determine EJ impacts of LSL presence and replacement in drinking water systems. The EPA provided the SAB with charge questions and shared the agency's preliminary analyses and draft results on case studies for three cities to help inform the agency's EJ analysis for the proposed LCRI (USEPA, 2022). The EPA charged the SAB with the following three questions:

- Are there potential environmental justice concerns associated with environmental stressors affected by the regulatory action for population groups of concern in the baseline?

- Are there potential environmental justice concerns associated with environmental stressors affected by the regulatory action for population groups of concern for each regulatory option under consideration?
- For each regulatory option under consideration, are potential environmental justice concerns created or mitigated compared to the baseline?

These questions asking the SAB to evaluate the potential EJ impacts of the proposed LCRI are in accord with Executive Order 12898, which directs agencies to "identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations" (59 FR 7629, February 16, 1994).

The EPA also sought an evaluation of the three of the agency's draft case studies for the proposed LCRI EJ analysis. The EPA asked the SAB to evaluate the following four EJ issues: 1) the tools, indicators, and metrics the EPA should consider when developing LSLR case studies; 2) whether a sub-set of variables within these indices that should be given higher weights in the LCRI EJ assessment; 3) the indicator/measure that is most suitable for studying the EJ impacts associated with LSLs and their replacement; and 4) whether any of the tools or indicators under consideration for use in the LCRI EJ assessment could help to better assess lead impacts from other co-located exposure pathways to inform the EPA's understanding of lead exposures from non-drinking water sources.

The SAB deliberated and sought input from public meetings held on November 3 and 4, 2022. The SAB provided initial verbal advice and comments on the proposed rule and case studies, as well as written comments through November 21, 2022. The SAB provided its final report to the EPA Administrator on December 20, 2022, regarding the agency's EJ analysis for LCRI (USEPA, 2022).

SAB members recommended using indicators from multiple tools (*e.g.*, EJScreen, Center for Disease Control and Prevention's (CDC's) Environmental Justice Index (EJI), CDC/Agency for Toxic Substances and Disease registry (ATSDR) Social Vulnerability Index (SVI), Area Deprivation Index (ADI)) in order to more effectively identify communities that are disproportionately burdened by lead exposure and evaluate EJ impacts of LSLs and LSLR. Recommended indicators for studying LSL and LSLR EJ impacts included minority populations, low-income population, population under age 5, pre-1960 housing, pre-1980 housing, people with disabilities, single-parent households, occupied housing units without complete plumbing, proximity to lead mines, hazardous waste proximity, superfund proximity, and particulate matter (PM) 2.5. Some members also suggested that the EPA focus on indicators most relevant to children, such as children under age 5, maternal education, birth weight, and quality of home environment, because children are most sensitive to the effects of lead. Some members also suggested giving higher weights to indicators that address populations disproportionately vulnerable to lead exposure and its adverse health effects, such as population under 5 years old and low-income communities, because they are more likely to consume tap water. Additional indicators suggested for weighting were location based, including residential areas near legacy pollution sites. Recommended tools to consider lead from other pathways included EJScreen, SVI, ADI, and EJI. Some SAB members also recommended using proximity to traffic and pre-1960s housing, as these could indicate compound lead exposure from pathways other than drinking water.

As a result of the consultation, the EPA incorporated the suggestions from the SAB in a study of the EJ implications of the LCRI (USEPA, 2023). The EPA evaluated correlations between per capita LSLs (in a

Census block group) and different ethnic groups including American Indian or Alaska Native, Asian or Pacific Islander, Other or Two Races, Hispanic, Non-Hispanic Black, and Non-Hispanic white. The EPA also evaluated the relationship between the presence of LSLs and indicators representing the populations most at risk of lead exposure, such as low income and children under age 5. Indicators addressing characteristics that are associated with exposure to other lead sources were also incorporated in the study including structures built prior to 1960 and proximity to traffic. Additional information on SAB recommendations is included in the SAB report (USEPA, 2022) available in the docket EPA-HQ-OW-2022-0801 at www.regulations.gov.

7.12.2 Consultation with National Drinking Water Advisory Council (NDWAC)

The NDWAC is a Federal Advisory Committee that supports the EPA in performing its duties and responsibilities related to the national drinking water program and was created through a provision in SDWA in 1974. In accordance with section 1412(d) of SDWA, the EPA consulted with the NDWAC on both the proposed and final LCRI. These consultations are further described in this section.

On November 30, 2022, the EPA held a public teleconference with NDWAC during which the EPA presented the proposed LCRI and solicited input from the NDWAC. The EPA provided background on lead in drinking water and the LCR, an overview of the 2021 LCRR published in January 2021, annualized cost estimates from the 2021 LCRR EA, and a summary of the outcome of the EPA's review of the 2021 LCRR. The NDWAC provided key input on four key areas: service line replacement, tap sampling and compliance, reducing rule complexity, and small system flexibility. The public was also given an opportunity to provide their comments to the NDWAC. A summary of the NDWAC consultation is available in the NDWAC, Fall 2022 Meeting Summary Report (NDWAC, 2022) and in the docket EPA-HQ-OW-2022-0801 at www.regulations.gov.

On January 31, 2024, the EPA held a public teleconference to consult with the NDWAC on the final LCRI. The EPA provided an overview of the proposed LCRI as well as key revisions in the proposed rule. The public was also given an opportunity to provide their comments to the NDWAC. A summary of the NDWAC meeting, the public comments to the NDWAC, and the EPA's presentation are available in the NDWAC Summary Report (NDWAC, 2024) and is also available in the docket.

7.12.3 Consultation with Health and Human Services

In accordance with section 1412(d) of SDWA, on August 18, 2023, the EPA consulted with the Department of Health and Human Services (HHS) on the proposed LCRI and on July 15, 2024, the EPA consulted with the HHS on the final rule. The EPA provided information to HHS officials on both the proposed LCRI and the draft final LCR. The EPA received and considered comments from the HHS for both the proposal and final rule through the interagency review process under Executive Order 12866.

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8 Other Options Considered

8.1 Introduction

This chapter presents alternative options the United States Environmental Protection Agency (EPA) considered when developing the final Lead and Copper Rule Improvements (LCRI) related to: the required lead action level (AL); the service line replacement (SLR) rate; the definition of lead content to be replaced as part of the SLR program; the potential for deferred deadlines under the SLR program; changes to the lead tap sampling schedule; the temporary filter requirements under a multiple lead action level exceedance (ALE) program; and the size threshold of the small system compliance flexibility. Due to the large number of alternative options considered, this analysis uses the high scenario assumptions to illustrate how their monetized benefits and costs compare to those of the final LCRI. Also note that EPA has feasibility concerns with the implementation of some of the alternative options analyzed which raises the level of uncertainty associated with the estimated cost and benefit values for those alternatives. The agency has noted in the following subsections the alternative options impacted by feasibility concerns. Exhibit 8-1 provides a detailed summary of the final LCRI requirements and the alternative options considered.

Exhibit 8-1: Summary of Alternative Other Options Considered for the Final LCRI

Area	Alternative Option Considered	Final LCRI
Lead Action Level	1. Lead AL of ≤0.015 mg/L 2. Lead AL of ≤0.005 mg/L	Lead AL of ≤0.010 mg/L (proposed rule)
Service Line Replacement Rate	Service lines are replaced at an annual rate of 7%	Service lines are replaced at an annual rate of 10% (proposed rule)
Definition of Lead Content to be Replaced	Systems must replace lead service lines and galvanized lines previously downstream of lead lines or unknown lead content lines, and lead connectors and galvanized lines previously downstream of lead connectors	Systems must replace lead service lines and galvanized lines previously downstream of lead lines or unknown lead content lines. Lead connectors are replaced when encountered (proposed rule)
SLR Deferred Deadline	1. Systems may be given a deferred deadline for finishing all LSL and GRR replacements resulting in a maximum rate which is the lower of 10,000 lines per year or 39 replacements per 1000 connections per year (proposed rule–with change to connections per year from households per year) 2. Systems may be given a deferred deadline for finishing all LSL and GRR replacements resulting in a maximum rate which is the lower of 8,000 lines per year or 39 replacements per 1000 connections per year	Systems may be given a deferred deadline for finishing all LSL and GRR replacements resulting in a maximum rate of 39 replacements per 1000 connections per year

Area	Alternative Option Considered	Final LCRI
Lead Tap Sampling	All systems return to standard 6-month monitoring with an ALE. Systems with lead, GRR, and/or unknown service lines at the compliance date conduct standard 6-month monitoring at the compliance date and non-lead service line systems remain on LCR monitoring schedule until new LCRI protocol sampling may change P90. When (& if) a non-lead system finds an LSL/GRR they return to 6-month monitoring. (proposed rule). Systems that sampled using the new protocol and are below the LCRI AL prior to the compliance date may qualify to retain their current schedule.	All systems return to standard 6-month monitoring with an ALE. Systems with lead and GRR service lines return to standard 6-month monitoring at compliance date. Unknown and non-lead systems remain on LCR monitoring schedule until new LCRI protocol sampling may change P90. When (& if) a non-lead/all unknown system finds an LSL/GRR they return to 6-month monitoring. Systems with lead and GRR service lines that sampled using the new protocol and are below the LCRI AL prior to the compliance date may qualify to retain their current schedule.
Multiple ALE Filter Programs	Systems with at least 2 lead ALEs in a rolling 5-year period must prepare and submit a filter plan to State. Systems with at least 3 lead ALEs in a rolling 5-year period must: 1. Make filters available to all customers with lead, GRR, and unknown lead content service lines 2. Deliver temporary filters directly to all customers	Systems with at least 2 lead ALEs in a rolling 5-year period must prepare and submit a filter plan to State. Systems with at least 3 lead ALEs in a rolling 5-year period must make filters available to all customers (proposed rule– with filter plan being required after 2 ALEs instead of 3 ALEs for the final rule)
Small System Flexibility	CWSs that serve 10,000 or fewer people, and all NTNCWSs, are provided compliance flexibility when they exceed the AL	CWSs that serve 3,300 or fewer people, and all NTNCWSs, are provided compliance flexibility when they exceed the AL (proposed rule)

Acronyms: AL = action level; ALE = action level exceedance; CWS = community water system; GRR = galvanized requiring replacement; LCR = Lead and Copper Rule; LCRI = Lead and Copper Rule Improvements; LSL = lead service line; NTNCWS = non-transient non-community water system; P90 = lead 90th percentile level; SLR = service line replacement.

Note: (Proposed Rule) indicates if a final rule component or alternative option were originally considered as part of the proposed LCRI.

8.2 Alternative Lead Action Levels

The EPA's final LCRI set the AL at 0.010 mg/L. The agency, as part of the final rule development process, also considered two alternative lead ALs, ≤0.005 mg/L or ≤0.015 mg/L.

Exhibit 8-2 and Exhibit 8-3 compare the quantified costs and benefits of the final LCRI to the quantified costs and benefits at an AL of 0.015 mg/L holding all other final LCRI rule requirements constant. Results in these tables are provided for the high scenario at a 2 percent discount rate.[217]

[217] Note the following for all cost results in this chapter: All cost tables provide estimates for household cost of LSLR under the 2021 Lead and Copper Rule Revisions (LCRR) baseline but this value is not computed for the LCRI. The EPA in the 2021 LCRR economic analysis (USEPA, 2020) assumed that the cost of customer-side SLRs made under the goal-based replacement requirement would be paid for by households. The agency also assumed that system-side SLRs under the goal-based replacement requirement and all SLRs (both customer-side and systems-side) would be paid by the public water system (PWS) under the 3 percent mandatory replacement requirement. The EPA made these modeling assumptions based on the different levels of regulatory responsibility systems faced operating under a goal-based replacement requirement versus a mandatory replacement requirement. While systems would not be subject to a potential violation for not meeting the replacement target under the goal-based replacement requirement, under the 3 percent mandatory replacement requirement the possibility of a violation could motivate more systems to meet the replacement target even if they had to adopt customer incentive programs that would shift the cost of replacing customer-side service lines from customers to the system. The EPA cannot require such incentive programs within a National Primary Drinking Water Regulation (NPDWR). To be consistent with these 2021 LCRR modeling assumptions, under the final LCRI, the EPA assumed that mandatory replacement costs would fall only on systems. Therefore, the negative incremental values reported for the "Household SLR Costs" category do not represent a net cost savings to households. They represent an assumed shift of the estimated SLR costs from households to systems. Note, however, that systems might pass along these costs to rate payers. The EPA has insufficient information to estimate the actual SLR cost sharing relationship between customers and systems at the national level of analysis.

Exhibit 8-2: Estimated National Annualized Rule Cost Comparison Between the Final LCRI and Alternative Lead Action Level Option (AL ≤ 0.015 mg/L) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (AL ≤ 0.015 mg/L)		
	Baseline	LCRI	Incremental	Baseline	LCRI	Incremental
PWS Annual Costs						
Sampling	\$143.6	\$176.2	\$32.6	\$143.6	\$168.1	\$24.5
PWS SLR	\$124.5	\$1,763.9	\$1,639.4	\$124.5	\$1,765.2	\$1,640.7
Corrosion Control Technology	\$647.8	\$692.9	\$45.1	\$647.8	\$621.1	-\$26.7
Point-of Use Installation and Maintenance	\$5.9	\$9.6	\$3.7	\$5.9	\$5.6	-\$0.3
Public Education and Outreach	\$72.1	\$302.2	\$230.1	\$72.1	\$274.7	\$202.6
Rule Implementation and Administration	\$0.2	\$3.4	\$3.2	\$0.2	\$3.4	\$3.2
Total Annual PWS Costs	***\$994.1***	***\$2,948.2***	***\$1,954.1***	***\$994.1***	***\$2,838.1***	***\$1,844.0***
Household SLR Costs	\$26.4	\$0.0	-\$26.4	\$26.4	\$0.0	-\$26.4
State Rule Implementation and Administration	\$41.8	\$67.6	\$25.8	\$41.8	\$66.2	\$24.4
Wastewater Treatment Plant Costs	\$4.8	\$5.1	\$0.3	\$4.8	\$3.3	-\$1.5
Total Annual Rule Costs	**\$1,067.1**	**\$3,020.9**	**\$1,953.8**	**\$1,067.1**	**\$2,907.6**	**\$1,840.5**

Acronyms: AL = action level; LCRI = Lead and Copper Rule Improvements; PWS = public water system; SLR = service line replacement; USD = United States dollar.

Notes: (1) Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.

(2) Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Exhibit 8-3: Estimated National Annual Benefit Comparison Between the Final LCRI and Alternative Lead Action Level Option (AL ≤ 0.015 mg/L) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (AL ≤ 0.015 mg/L)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual IQ Benefits	$3,279.0	$10,963.0	$7,684.0	$3,279.0	$10,586.0	$7,307.0
Annual Low-Birth Weight Benefits	$1.8	$5.7	$3.9	$1.8	$5.5	$3.7
Annual ADHD Benefits	$179.9	$599.5	$419.6	$179.9	$580.4	$400.5
Annual Adult CVD Premature Mortality Benefits	$8,174.9	$25,210.0	$17,035.1	$8,174.9	$24,203.4	$16,028.5
Total Annual Benefits	**$11,635.6**	**$36,778.2**	**$25,142.6**	**$11,635.6**	**$35,375.3**	**$23,739.7**

Acronyms: ADHD = attention-deficit/hyperactivity disorder; AL = action level; CVD = cardiovascular disease; IQ = intelligence quotient; LCRI = Lead and Copper Rule Improvements; USD = United States dollar.
Note: Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Exhibit 8-4 and Exhibit 8-5 compare the quantified costs and benefits of the final LCRI to the quantified costs and benefits at an AL of 0.005 mg/L holding all other final LCRI rule requirements constant. Results in these tables are provided for the high scenario at a two percent discount rate. Note that the estimated results for the alternative option, which assumes water systems can achieve lead levels below a lead AL of ≤ 0.005 mg/L is feasible, must be viewed as having a higher degree of uncertainty. Although the EPA has adjusted ALE data that allows for the calculation of the cost and benefits of this alternative, the agency has concerns about the feasibility of implementing this option. See section IV.F.4 of the *Federal Register* Notice (USEPA, 2024) for a detailed discussion of the lead AL and its function to support the feasibility of the CCT treatment technique.

Exhibit 8-4: Estimated National Annualized Rule Cost Comparison Between the Final LCRI and Alternative Lead Action Level Option (AL ≤ 0.005 mg/L) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (AL ≤ 0.005 mg/L)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS Annual Costs						
Sampling	$143.6	$176.2	$32.6	$143.6	$198.7	$55.1
PWS SLR	$124.5	$1,763.9	$1,639.4	$124.5	$1,762.4	$1,637.9
Corrosion Control Technology	$647.8	$692.9	$45.1	$647.8	$819.4	$171.6
Point-of Use Installation and Maintenance	$5.9	$9.6	$3.7	$5.9	$15.7	$9.8
Public Education and Outreach	$72.1	$302.2	$230.1	$72.1	$374.2	$302.1
Rule Implementation and Administration	$0.2	$3.4	$3.2	$0.2	$3.6	$3.4
Total Annual PWS Costs	***$994.1***	***$2,948.2***	***$1,954.1***	***$994.1***	***$3,174.0***	***$2,179.9***
Household SLR Costs	$26.4	$0.0	-$26.4	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$41.8	$67.6	$25.8	$41.8	$71.7	$29.9
Wastewater Treatment Plant Costs	$4.8	$5.1	$0.3	$4.8	$8.2	$3.4
Total Annual Rule Costs	**$1,067.1**	**$3,020.9**	**$1,953.8**	**$1,067.1**	**$3,253.9**	**$2,186.8**

Acronyms: AL = action level; LCRI = Lead and Copper Rule Improvements; PWS = public water system; SLR = service line replacement; USD = United States dollar.

Notes: (1) Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.

(2) Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Exhibit 8-5: Estimated National Annual Benefit Comparison Between the Final LCRI and Alternative Lead Action Level Option (AL ≤ 0.005 mg/L) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (AL ≤ 0.005 mg/L)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual IQ Benefits	$3,279.0	$10,963.0	$7,684.0	$3,279.0	$11,651.2	$8,372.2
Annual Low-Birth Weight Benefits	$1.8	$5.7	$3.9	$1.8	$6.0	$4.2
Annual ADHD Benefits	$179.9	$599.5	$419.6	$179.9	$634.9	$455.0
Annual Adult CVD Premature Mortality Benefits	$8,174.9	$25,210.0	$17,035.1	$8,174.9	$27,044.4	$18,869.5
Total Annual Benefits	**$11,635.6**	**$36,778.2**	**$25,142.6**	**$11,635.6**	**$39,336.5**	**$27,700.9**

Acronyms: ADHD = attention-deficit/hyperactivity disorder; AL = action level; CVD = cardiovascular disease; IQ = intelligence quotient; LCRI = Lead and Copper Rule Improvements; USD = United States dollar.
Note: Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

The EPA identified 0.010 mg/L as being generally representative of OCCT based on updated data and over 30 years of LCR implementation experience (see section IV.F.4 of the *Federal Register* notice for a discussion on the action level analysis). In selecting this action level, the EPA considered what is technically possible for small and medium systems in light of the identified challenges that still exist, including their fewer resources and more limited technical capacity compared to large systems and a limited number of CCT experts available nationally. Therefore, the EPA has determined that an action level of 0.010 mg/L would support the treatment technique for CCT overall, in addition to other elements of this treatment technique, and is the most health protective level technically possible; it thus meets the feasibility standard at SDWA section 1412(b)(7)(A).

Given the concerns over feasibility and therefore the uncertainty associated with the estimated costs and benefits of this alternative option, the EPA is discounting the fact that estimated net benefits for this alternative option are greater than the estimated net benefits for the final LCRI. The LCRI maintains the lead action level at ≤ 0.010 mg/L.

8.3 Alternative Service Line Replacement Rate

The final LCRI sets the required SLR rate at 10 percent per year, unless subject to a shortened or deferred deadline. The agency as part of the proposal development process also considered an alternative SLR rate, 7 percent per year.

Exhibit 8-6 and Exhibit 8-7 compare the quantified costs and benefits of the final LCRI to the quantified costs and benefits of the rule with an alternative SLR rate of 7 percent, holding all other rule requirements constant. Results are provided for the high scenario at a 2 percent discount rate.

Exhibit 8-6: Estimated National Annualized Rule Cost Comparison Between the Final LCRI and Alternative Service Line Replacement Option (SLR Rate = 7%) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (SLR Rate = 7%)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS Annual Costs						
Sampling	$143.6	$176.2	$32.6	$143.6	$176.1	$32.5
PWS SLR	$124.5	$1,763.9	$1,639.4	$124.5	$1,672.2	$1,547.7
Corrosion Control Technology	$647.8	$692.9	$45.1	$647.8	$696.0	$48.2
Point-of Use Installation and Maintenance	$5.9	$9.6	$3.7	$5.9	$10.2	$4.3
Public Education and Outreach	$72.1	$302.2	$230.1	$72.1	$341.0	$268.9
Rule Implementation and Administration	$0.2	$3.4	$3.2	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$994.1***	***$2,948.2***	***$1,954.1***	***$994.1***	***$2,898.9***	***$1,904.8***
Household SLR Costs	$26.4	$0.0	-$26.4	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$41.8	$67.6	$25.8	$41.8	$67.7	$25.9
Wastewater Treatment Plant Costs	$4.8	$5.1	$0.3	$4.8	$5.2	$0.4
Total Annual Rule Costs	**$1,067.1**	**$3,020.9**	**$1,953.8**	**$1,067.1**	**$2,971.8**	**$1,904.7**

Acronyms: LCRI = Lead and Copper Rule Improvements; PWS = public water system; SLR = service line replacement; USD = United States dollar.

Notes: (1) Previous Baseline costs are projected over the 35-year period of analysis and are affected by EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.

(2) Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Exhibit 8-7: Estimated National Annual Benefit Comparison Between the Final LCRI and Alternative Service Line Replacement Option (SLR Rate = 7%) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (SLR Rate = 7%)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual IQ Benefits	$3,279.0	$10,963.0	$7,684.0	$3,279.0	$9,994.8	$6,715.8
Annual Low-Birth Weight Benefits	$1.8	$5.7	$3.9	$1.8	$5.2	$3.4
Annual ADHD Benefits	$179.9	$599.5	$419.6	$179.9	$540.5	$360.6
Annual Adult CVD Premature Mortality Benefits	$8,174.9	$25,210.0	$17,035.1	$8,174.9	$22,997.8	$14,822.9
Total Annual Benefits	**$11,635.6**	**$36,778.2**	**$25,142.6**	**$11,635.6**	**$33,538.3**	**$21,902.7**

Acronyms: ADHD = attention-deficit/hyperactivity disorder; CVD = cardiovascular disease; IQ = intelligence quotient; LCRI = Lead and Copper Rule Improvements; SLR = service line replacement USD = United States dollar.
Note: Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

8.4 Alternative Definition of Lead Content Service Lines to Be Replaced

The final LCRI requires that systems replace lead connectors as they are encountered but does not include these lead connectors or galvanized lines previously downstream of lead connectors as part of the 10 percent of lead content lines that must be replaced annually. The EPA as part of the final rule development process also considered an alternative definition of lead content service lines that are required to be replaced. This alternative definition included lead service lines (LSLs) and galvanized service lines downstream from a LSL or unknown lead content service line but also required the replacement of lead connectors and galvanized lines downstream from lead connectors. The unit cost for replacing a galvanized line downstream of a lead connector is the same as replacing a galvanized requiring replacement (GRR) service line. For the unit cost of replacing a lead connector, the EPA used a low and a high estimate to represent uncertainty. The low estimate is based on experiences of Portland Oregon, where they found the average cost to replace a lead connector to be $1,891 (in 2020 dollars). The high estimate is based on partial SLR cost. Although the lead gooseneck is only 2 feet and the system-owned service line length is an average of 30 feet (Sandvig et al., 2008), replacing a gooseneck still involves digging in the street, mobilization, and traffic coordination. As the high estimate, the EPA approximated the cost to replace a connector as the average cost of a partial SLR divided by 2 ($3803/2 = $1902 in 2020 dollars). For more details, see the derivation file “LSLR Unit Costs.xlsx”, worksheet “LSLR for Connectors”, available in the docket at EPA-HQ-OW-2022-0801 at www.regulations.gov. For the benefits analysis, the EPA estimated the benefits of these two types of replacements to be the same as a partial replacement or GRR, in the absence of detailed lead concentration data for these scenarios.

Exhibit 8-8 and Exhibit 8-9 compare the quantified costs and benefits of the final LCRI to the quantified costs and benefits of requiring all lead connectors and all galvanized lines downstream and previously downstream from lead connectors be replaced along with LSLs and galvanized downstream of a lead line or unknown lead content service line at the 10 percent annual replacement rate. Results are provided for the high scenario at a 2 percent discount rate. As discussed in sections IV.B.2 and IV.O.3 of the *Federal Register* Notice (USEPA, 2024) both the complete inventorying and mandatory removal of lead connectors and galvanized service lines downstream and previously downstream of lead connectors is not feasible without significantly delaying the replacement of lead and GRR service lines. Therefore, note that although the EPA was able to estimate costs and benefits for this alternative option, using the 7th Drinking Water Infrastructure Needs Survey and Assessment survey data on lead content service lines, the estimated results are uncertain and likely overestimate both costs and benefits since full lead and GRR SLR is assumed to still occur within the required 10 year window (except for those systems on deferred deadlines) when in fact these replacement may be delayed as a result of implementing the requirements of this option. Given the concerns over feasibility and therefore the uncertainty associated with the estimated costs and benefits of this alternative option (note benefits estimates would be overestimated to a larger extent than costs), the EPA is discounting the fact that estimated net benefits for this alternative option are greater than the estimated net benefits for the final LCRI. The final LCRI maintains the final rules requirement to replace all LSLs and galvanized service lines downstream of LSLs or unknown lead content service lines at the 10 percents annual replacement rate (except for those systems on deferred deadlines).

Exhibit 8-8: Estimated National Annualized Rule Cost Comparison Between the Final LCRI and Alternative Option Including Lead Connectors in Definition of Service Lines to be Replaced - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (Lead Connectors and Galvanized Lines Previously Downstream of Lead Connectors Must be Replaced)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS Annual Costs						
Sampling	$143.6	$176.2	$32.6	$143.6	$176.4	$32.8
PWS SLR	$124.5	$1,763.9	$1,639.4	$124.5	$1,921.7	$1,797.2
Corrosion Control Technology	$647.8	$692.9	$45.1	$647.8	$701.3	$53.5
Point-of Use Installation and Maintenance	$5.9	$9.6	$3.7	$5.9	$9.7	$3.8
Public Education and Outreach	$72.1	$302.2	$230.1	$72.1	$306.6	$234.5
Rule Implementation and Administration	$0.2	$3.4	$3.2	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$994.1***	***$2,948.2***	***$1,954.1***	***$994.1***	***$3,119.1***	***$2,125.0***
Household SLR Costs	$26.4	$0.0	-$26.4	$26.4	$0.0	-$26.4

	Final Rule			Alternative Option (Lead Connectors and Galvanized Lines Previously Downstream of Lead Connectors Must be Replaced)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
State Rule Implementation and Administration	$41.8	$67.6	$25.8	$41.8	$67.9	$26.1
Wastewater Treatment Plant Costs	$4.8	$5.1	$0.3	$4.8	$5.3	$0.5
Total Annual Rule Costs	**$1,067.1**	**$3,020.9**	**$1,953.8**	**$1,067.1**	**$3,192.3**	**$2,125.2**

Acronyms: LCRI = Lead and Copper Rule Improvements; SLR = service line replacement; PWS = public water system; USD = United States dollar.

Notes: (1) Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.

(2) Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Exhibit 8-9: Estimated National Annual Benefit Comparison Between the Final LCRI and Alternative Option Including Lead Connectors in Definition of Service Lines to be Replaced - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (Lead Connectors and Galvanized Lines Previously Downstream of Lead Connectors Must be Replaced)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual IQ Benefits	$3,279.0	$10,963.0	$7,684.0	$3,279.0	$12,646.8	$9,367.8
Annual Low-Birth Weight Benefits	$1.8	$5.7	$3.9	$1.8	$6.4	$4.6
Annual ADHD Benefits	$179.9	$599.5	$419.6	$179.9	$684.8	$504.9
Annual Adult CVD Premature Mortality Benefits	$8,174.9	$25,210.0	$17,035.1	$8,174.9	$28,943.5	$20,768.6
Total Annual Benefits	**$11,635.6**	**$36,778.2**	**$25,142.6**	**$11,635.6**	**$42,281.5**	**$30,645.9**

Acronyms: ADHD = attention-deficit/hyperactivity disorder; CVD = cardiovascular disease; IQ = intelligence quotient; LCRI = Lead and Copper Rule Improvements; USD = United States dollar.

Note: Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

8.5 Alternative Service Line Replacement Deferral Deadline

Under the final LCRI, systems are eligible for a deferred deadline (or rate) for mandatory SLR if replacing 10 percent of the system's known lead and GRR service lines from the replacement pool (the total number of lead and GRR service lines) would require the replacement of more than 39 annual replacements per 1,000 service connections. Effectively, the criteria for a system to be eligible for a deferred deadline is to exceed 39 annual replacements per 1,000 service connections. The EPA considered, as part of the development of the final rule, two deferred deadline criteria in addition to the final rule's per-connection rate: 1) systems may also be able to take advantage of a reduced maximum replacement rate set at 10,000 lines per year if the rate is lower than the required 39 replacements per 1000 connections metric; and 2) systems may also be able to take advantage of a reduced maximum replacement rate set at 8,000 lines per year if the rate is lower than the required 39 replacements per 1000 connections metric.

Exhibit 8-10 and Exhibit 8-11 compare the quantified costs and benefits of the final LCRI to the quantified costs and benefits under an alternative SLR deferred deadline which would allow systems to replace lead and GRR service lines at a maximum rate equal to the lower of two alternatives: 1) 10,000 lines per year; or 2) 39 replacements per 1000 connections per year, holding all other rule requirements constant. Results are provided for the high scenario at a two percent discount rate.

Exhibit 8-10: Estimated National Annualized Rule Cost Comparison Between the Final LCRI and Alternative Deferred Deadline Option (Adding Max Rate of 10,000 SL Per Year) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (SL Replacement Deferred Deadline with Additional Potential Maximum Rate of 10,000 SL Per Year)		
	Baseline	LCRI	Incremental	Baseline	LCRI	Incremental
PWS Annual Costs						
Sampling	$143.6	$176.2	$32.6	$143.6	$176.0	$32.4
PWS SLR*	$124.5	$1,763.9	$1,639.4	$124.5	$1,763.1	$1,638.6
Corrosion Control Technology	$647.8	$692.9	$45.1	$647.8	$692.8	$45.0
Point-of Use Installation and Maintenance	$5.9	$9.6	$3.7	$5.9	$9.7	$3.8
Public Education and Outreach	$72.1	$302.2	$230.1	$72.1	$302.4	$230.3
Rule Implementation and Administration	$0.2	$3.4	$3.2	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$994.1***	***$2,948.2***	***$1,954.1***	***$994.1***	***$2,947.4***	***$1,953.3***

Household SLR Costs**	$26.4	$0.0	-$26.4	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$41.8	$67.6	$25.8	$41.8	$67.6	$25.8
Wastewater Treatment Plant Costs***	$4.8	$5.1	$0.3	$4.8	$5.0	$0.2
Total Annual Rule Costs	**$1,067.1**	**$3,020.9**	**$1,953.8**	**$1,067.1**	**$3,020.0**	**$1,952.9**

Acronyms: LCRI = Lead and Copper Rule Improvements; PWS = public water system; SL = service line; SLR = service line replacement; USD = United Stated dollar.
Notes: (1) Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.
(2) Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Exhibit 8-11: Estimated National Annual Benefit Comparison Between the Final LCRI and Alternative Deferred Deadline Option (Adding Max Rate of 10,000 SL Per Year) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			**Alternative Option (SL Replacement Deferred Deadline with Additional Potential Maximum Rate of 10,000 SL Per Year)**		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual IQ Benefits	$3,279.0	$10,963.0	$7,684.0	$3,279.0	$10,960.3	$7,681.3
Annual Low-Birth Weight Benefits	$1.8	$5.7	$3.9	$1.8	$5.7	$3.9
Annual ADHD Benefits	$179.9	$599.5	$419.6	$179.9	$599.3	$419.4
Annual Adult CVD Premature Mortality Benefits	$8,174.9	$25,210.0	$17,035.1	$8,174.9	$25,203.7	$17,028.8
Total Annual Benefits	**$11,635.6**	**$36,778.2**	**$25,142.6**	**$11,635.6**	**$36,769.0**	**$25,133.4**

Acronyms: ADHD = attention-deficit/hyperactivity disorder; CVD = cardiovascular disease; IQ = intelligence quotient; LCRI = Lead and Copper Rule Improvements; SL = service line; USD = United States dollar.
Note: Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Exhibit 8-12 and Exhibit 8-13 compare the quantified costs and benefits of the final LCRI to the quantified costs and benefits under an alternative SLR deferred deadline which would allow systems to replace lead and GRR service lines at a maximum rate equal to the lower of two alternatives: 1) 8,000 lines per year; or 2) 39 replacements per 1000 connections per year, holding all other rule requirements constant. Results are provided for the high scenario at a two percent discount rate.

Exhibit 8-12: Estimated National Annualized Rule Cost Comparison Between the Final LCRI and Alternative Deferred Deadline Option (Adding Max Rate of 8,000 SL Per Year) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (SL Replacement Deferred Deadline with Additional Potential Maximum Rate of 8,000 SL Per Year)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS Annual Costs						
Sampling	$143.6	$176.2	$32.6	$143.6	$176.0	$32.4
PWS SLR	$124.5	$1,763.9	$1,639.4	$124.5	$1,761.8	$1,637.3
Corrosion Control Technology	$647.8	$692.9	$45.1	$647.8	$692.8	$45.0
Point-of Use Installation and Maintenance	$5.9	$9.6	$3.7	$5.9	$9.7	$3.8
Public Education and Outreach	$72.1	$302.2	$230.1	$72.1	$302.7	$230.6
Rule Implementation and Administration	$0.2	$3.4	$3.2	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$994.1***	***$2,948.2***	***$1,954.1***	***$994.1***	***$2,946.4***	***$1,952.3***
Household SLR Costs	$26.4	$0.0	-$26.4	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$41.8	$67.6	$25.8	$41.8	$67.6	$25.8
Wastewater Treatment Plant Costs	$4.8	$5.1	$0.3	$4.8	$5.0	$0.2
Total Annual Rule Costs	**$1,067.1**	**$3,020.9**	**$1,953.8**	**$1,067.1**	**$3,019.0**	**$1,951.9**

Acronyms: LCRI = Lead and Copper Rule Improvements; PWS = public water system; SL = service line; SLR = service line replacement; USD = United Stated dollar.

Notes: (1) Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.

(2) Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Exhibit 8-13: Estimated National Annual Benefit Comparison Between the Final LCRI and Alternative Deferred Deadline Option (Adding Max Rate of 8,000 SL Per Year) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

		Final Rule		Alternative Option (SL Replacement Deferred Deadline with Additional Potential Maximum Rate of 8,000 SL Per Year)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual IQ Benefits	$3,279.0	$10,963.0	$7,684.0	$3,279.0	$10,943.3	$7,664.3
Annual Low-Birth Weight Benefits	$1.8	$5.7	$3.9	$1.8	$5.7	$3.9
Annual ADHD Benefits	$179.9	$599.5	$419.6	$179.9	$598.3	$418.4
Annual Adult CVD Premature Mortality Benefits	$8,174.9	$25,210.0	$17,035.1	$8,174.9	$25,164.0	$16,989.1
Total Annual Benefits	**$11,635.6**	**$36,778.2**	**$25,142.6**	**$11,635.6**	**$36,711.3**	**$25,075.7**

Acronyms: ADHD = attention-deficit/hyperactivity disorder; CVD = cardiovascular disease; IQ = intelligence quotient; LCRI = Lead and Copper Rule Improvements; SL = service line; USD = United States dollar.
Note: Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

8.6 Alternative Tap Sampling Requirements

Under the final LCRI there are a number of criteria that can result in a system starting standard six-month lead tap sample monitoring. Systems are required to conduct six-month lead tap sample monitoring if the system: has an ALE; has known lead and/or GRR service lines at LCRI compliance date; or discovers any LSLs and/or GRR service lines after the compliance date (unless the system replaces all the discovered service lines prior to the next tap monitoring period); in addition to other criteria unchanged from the Lead and Copper Rule Revisions (LCRR). Note that under the final LCRI requirements non-lead and non-lead/unknown service line systems remain on their existing Lead and Copper Rule (LCR) monitoring schedule at the rule compliance date. They remain on their previous tap sampling schedule until new sampling, which is compliant with the LCRI sampling protocols, may change the system's calculated P90 to exceed the AL. Also, systems with lead and GRR service lines that sampled using the new LCRI protocol (i.e., correct priority tiering sites, correct sample volume, and either first-liter sample (at non-lead service line sites) or first- and fifth-liter samples (at sites with LSLs)) and are below the LCRI AL prior to the compliance date may qualify to retain their current tap sampling schedule. As part of the development of the final rule, the EPA considered an alternative option that would also require systems with unknown lead content service lines (even when no lead and/or GRR service lines are known to be present in the system) to conduct standard six-month monitoring.

The EPA's analysis of this alternative option found that the expected increase in sampling cost and potential increase in benefits associated with systems (non-lead/unknown and 100 percent unknown) taking earlier corrective action as a result of ALEs were small and did not affect estimated national annualized cost and benefits at the $100,000 significant digit level. Therefore, the EPA is not presenting exhibits characterizing the differences between the estimated costs and benefit of the final rule and the lead tap sampling alternative option. However, it is important to note that the EPA has feasibility concerns associated with the alternative option. The additional cost and burden to public water systems (PWSs) and States would draw resources away from the implementation of other LCRI rule components such as corrosion control treatment (CCT) and public education, and the implementation of tap sampling in higher risk locations. See section IV.E for further discussion. Because of these concerns it is likely that the estimated cost and benefit of the alternative option are less certain than those of the final rule.

8.7 Alternative Temporary Filter Programs for Systems with Multiple ALEs

The final LCRI includes a requirement that systems with at least two lead ALEs in a rolling year-year period must prepare and submit a filter plan to the State. In addition, if a system has three or more ALEs in a rolling five- year period, it must make filters available to all consumers in the distribution system. The EPA assessed two additional alternative filter programs while developing the final rule. Under both alternatives systems with at least two ALEs in a rolling five-year period will follow the final rule requirements to develop and submit to the State a filter plan. For systems with at least three ALEs in a rolling five-year window, alternative one would require systems to make temporary filters available to all customers having lead, GRR, and unknown lead content service lines. Alternative two would require systems to directly deliver temporary filters to all customers in the distribution system.

Exhibit 8-14 compares the quantified costs of the final LCRI to the quantified costs of requiring systems with at least three ALEs in a rolling five-year window to make filters available to households with lead, GRR, or unknown lead content service lines. Under this alternative temporary filter option all other final LCRI rule requirements have been held constant. Cost results are provided for the high scenario at the 2 percent discount rate.

Exhibit 8-14: Estimated National Annualized Rule Cost Comparison Between the Final LCRI and Alternative Temporary Filters Program for Multiple ALE Systems Option (Filters Made Available to Lead, GRR, and Unknown Service Line Customers Only) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (Temporary Filters Made Available to LSL, GRR, and Unknown Lead Content Service Line Customers in Systems Meeting Multiple ALE Criteria)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS Annual Costs						
Sampling	$143.6	$176.2	$32.6	$143.6	$176.1	$32.5

	Final Rule			Alternative Option (Temporary Filters Made Available to LSL, GRR, and Unknown Lead Content Service Line Customers in Systems Meeting Multiple ALE Criteria)		
	Baseline	LCRI	Incremental	Baseline	LCRI	Incremental
PWS SLR	$124.5	$1,763.9	$1,639.4	$124.5	$1,763.9	$1,639.4
Corrosion Control Technology	$647.8	$692.9	$45.1	$647.8	$692.9	$45.1
Point-of Use Installation and Maintenance	$5.9	$9.6	$3.7	$5.9	$9.6	$3.7
Public Education and Outreach	$72.1	$302.2	$230.1	$72.1	$274.8	$202.7
Rule Implementation and Administration	$0.2	$3.4	$3.2	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$994.1***	***$2,948.2***	***$1,954.1***	***$994.1***	***$2,920.7***	***$1,926.6***
Household SLR Costs	$26.4	$0.0	-$26.4	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$41.8	$67.6	$25.8	$41.8	$67.6	$25.8
Wastewater Treatment Plant Costs	$4.8	$5.1	$0.3	$4.8	$5.1	$0.3
Total Annual Rule Costs	**$1,067.1**	**$3,020.9**	**$1,953.8**	**$1,067.1**	**$2,993.4**	**$1,926.3**

Acronyms: ALE = action level exceedance; GRR = galvanized requiring replacement; LCRI = Lead and Copper Rule Improvements; LSL = lead service line; PWS = public water system; SLR = service line replacement; USD = United States dollar.

Notes: (1) Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.

(2) Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Because the EPA's benefit analysis cannot quantify benefits from reducing lead exposures at residences that do not initially have lead or GRR service lines, the estimated benefits for this option are equal to those estimated for the final rule and therefore are not repeated. See Exhibit 6-3 for the estimated benefits of both the final LCRI and this alternative option. A discussion of the EPA's lead concentration data can be found in Chapter 5, Section 5.2 The quantified benefits of the final rule are in fact a more accurate representation of the alternative option where filters would not be made available to non-lead, GRR, and unknown service line customers. The analysis for the final LCRI was not able to quantify the potential benefits of filter use at non-lead and GRR service line households, resulting in an underestimate of benefits. Therefore, although not shown in the estimated values, the benefits of the final LCRI are likely larger than those of the alternative option.

Exhibit 8-15 compares the quantified costs of the final LCRI to the quantified costs s of requiring systems with at least three ALEs in a rolling five-year window to directly deliver filters to all customers in the distribution system. Results are provided for the high scenario at a two percent discount rate. Again, the

EPA does not present benefit values for this option. The monetized benefits are equivalent to those of the final LCRI, see Exhibit 6-3. Given concerns over the potential to underestimate the cost impact of the final LCRI multiple ALE filter program, which is dependent on the number of customers in a system that chose to obtain a filter from the PWS, the EPA assumed a 100 percent customer filter pick-up rate. This assumption, made to ensure a conservative assessment of the cost impacts of the program could lead to a potential overestimate of the benefits of such a program. However, this potential to overestimate benefits is tempered by the fact that, as discussed above, the EPA can only calculate benefits accruing to households that initially have lead or GRR service lines. Therefore, although benefits accruing to this household group may be overestimated, the increased assumed pick-up rate among the non-lead and GRR households does not affect estimated benefits. So, given that both the final LCRI and the direct delivery of filters option assume 100 percent filter use rates in the estimation of benefits, the estimated benefits are equal and likely overestimated. It seems reasonable to postulate that the filter use rate may be higher for the direct delivery option, given the increased level of effort required of consumers to pick-up a filter from a PWS designated location under the LCRI (although the EPA has no documented information to indicated this is true) and therefore this option would result in greater benefits. Note, however, that the EPA has feasibility concerns, discussed in section IV.K.2 of the *Federal Register* Notice (USEPA, 2024), with the required direct delivery of temporary filters to all customers. Therefore, the alternative option costs and benefits are more uncertain and may be overestimated because the values assume timely implementation of the requirement.

Because the EPA is unable to quantify benefits from reducing lead exposures at residences that do not initially have lead or GRR service lines and given the concerns over the feasibility of requiring direct delivery of temporary filters to all customers, the EPA cannot wholly rely on estimates of net benefits to determine the optimal temporary filter program regulatory requirements when systems have multiple ALEs. Although the estimated net benefits for the “only make filters available to customers with lead, GRR, or unknown lead content service lines” are greater than those estimated for the final rule the EPA has determined that the additional non-quantifiable potential benefits associated with lead reductions at households that did not initially have lead or GRR service lines outweighs the additional cost of the final rule program. Also as stated above the EPA has feasibility concerns with the option requiring direct delivery to all customers. to the LCRI maintains the final rule requirement that, if a system has three or more ALEs in a rolling five-year period, it must make filters available to all consumers in the distribution system.

Exhibit 8-15: Estimated National Annualized Rule Cost Comparison Between the Final LCRI and Alternative Temporary Filters Program for Multiple ALE Systems Option (Deliver Filters to All Customers) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (Deliver Temporary Filters Directly to All Customers in Systems Meeting Multiple ALE Criteria)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS Annual Costs						
Sampling	$143.6	$176.2	$32.6	$143.6	$176.1	$32.5

	Final Rule			Alternative Option (Deliver Temporary Filters Directly to All Customers in Systems Meeting Multiple ALE Criteria)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS SLR	$124.5	$1,763.9	$1,639.4	$124.5	$1,763.9	$1,639.4
Corrosion Control Technology	$647.8	$692.9	$45.1	$647.8	$692.9	$45.1
Point-of Use Installation and Maintenance	$5.9	$9.6	$3.7	$5.9	$9.6	$3.7
Public Education and Outreach	$72.1	$302.2	$230.1	$72.1	$308.1	$236.0
Rule Implementation and Administration	$0.2	$3.4	$3.2	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$994.1***	***$2,948.2***	***$1,954.1***	***$994.1***	***$2,954.0***	***$1,959.9***
Household SLR Costs	$26.4	$0.0	-$26.4	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$41.8	$67.6	$25.8	$41.8	$67.6	$25.8
Wastewater Treatment Plant Costs	$4.8	$5.1	$0.3	$4.8	$5.1	$0.3
Total Annual Rule Costs	**$1,067.1**	**$3,020.9**	**$1,953.8**	**$1,067.1**	**$3,026.7**	**$1,959.6**

Acronyms: ALE = action level exceedance; LCRI = Lead and Copper Rule Improvements; PWS = public water system; SLR = service line replacement; USD = United States dollar.
Notes: (1) Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.
(2) Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

8.8 Small System Flexibility

The final LCRI includes compliance flexibility for community water systems (CWSs) that serve 3,300 or fewer people, and all non-transient non-community water system (NTNCWSs). If these water systems have a lead 90th percentile above the AL, or an ALE, the system can choose to install or reoptimizing CCT or choose the alternative of maintaining point-of-use (POU) devices or replacing all lead-bearing plumbing.[218] As part of the rule development process the EPA also considered the alternative CWS size threshold of serving 10,000 or fewer people. So, CWSs serving up to 10,000 would have the ability to selects between CCT and the alternative compliance options if they exceed the AL. Note that under both alternatives NTNCWSs of all sizes qualify for the compliance flexibility. Because providing and

[218] The EPA could not evaluate the cost of removing lead-bearing plumbing components from small systems, but the agency notes that, if a system should select this option, it would likely be considered the lowest cost alternative of the compliance options. Therefore, since the EPA has not included this option in its cost modeling, the agency's small system compliance costs may be overestimated.

maintaining POU devices is almost always more costly than installing or re-optimizing CCT, for CWSs serving greater than 3,300, the EPA does not expect systems in the 3,300 to 10,000 persons served size category to choose POU as a compliance strategy if provided the option. In fact, the EPA's modelling results predict only 11 PWSs of this size would choose POU over CCT. Therefore, both the expected incremental costs and benefits, between the final and alternative small system flexibility options, are similar.

Exhibit 8-16 and Exhibit 8-17, compare the quantified costs and benefits of the final LCRI to the quantified costs and benefits for the alternative option where the CWS compliance flexibility size threshold is equal to systems serving 10,000 or fewer persons. The final LCRI sets the CWS compliance flexibility threshold at systems serving 3,300 or fewer persons. Note under the final rule and the assess alternative NTNCWSs are allowed compliance flexibility. Results are provided for the high scenario at the 2 percent discount rate. The estimated costs and benefits under the alternative small system compliance flexibility threshold, of systems serving up to 10,000 persons, assumes the effective implementation of POU in place of system wide CCT. As discussed in section IV.I of the *Federal Register* Notice (USEPA, 2024) the agency finds that in CWSs serving greater than 3,300 persons it is highly unlikely that POU programs, given their complexity, will be implemented effectively and could not make a determination that a POU program is as effective as CCT at minimizing exposure to lead in water for systems serving more than 3,300 persons. For example, in the LCRI proposal, the EPA described a scenario in which a system that serves 3,301 consumers would have to provide and maintain approximately 1,000 POU devices (88 FR 84878, USEPA, 2023a). Every year, at least 300 POU devices would have to be monitored by the water system, which would require a significant coordination effort and over 300 household visits by the water system. Systems would also need to insure all POU devises are working correctly, and the filter media is replaced to insure lead removal. This could easily result in an additional 1,000 or more home visits per year. The burden required to undertake this compliance alternative and implement it correctly would be difficult for a water system serving more than 3,300 persons to carry out given financial, administrative, and technical limitations. Therefore, under the alternative threshold option the estimated costs and, to a larger degree, the estimated benefits are uncertain. Given the concerns over feasibility and therefore the uncertainty associated with the estimated costs and benefits of this alternative option, the EPA is discounting the fact that estimated net benefits for this alternative option are greater than the estimated net benefits for the final LCRI. The final LCRI maintains the small system compliance flexibility threshold at systems serving 3,300 or fewer persons.

Exhibit 8-16: Estimated National Annualized Rule Cost Comparison Between the Final LCRI and Alternative Small System Flexibility Option (Flexibility for CWSs Serving up to 10,000 Persons) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (Small System Flexibility for CWSs Serving up to 10,000 Persons)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS Annual Costs						
Sampling	$143.6	$176.2	$32.6	$143.6	$176.0	$32.4

	Final Rule			Alternative Option (Small System Flexibility for CWSs Serving up to 10,000 Persons)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
PWS SLR	$124.5	$1,763.9	$1,639.4	$124.5	$1,763.9	$1,639.4
Corrosion Control Technology	$647.8	$692.9	$45.1	$647.8	$692.7	$44.9
Point-of Use Installation and Maintenance	$5.9	$9.6	$3.7	$5.9	$9.6	$3.7
Public Education and Outreach	$72.1	$302.2	$230.1	$72.1	$302.0	$229.9
Rule Implementation and Administration	$0.2	$3.4	$3.2	$0.2	$3.4	$3.2
Total Annual PWS Costs	***$994.1***	***$2,948.2***	***$1,954.1***	***$994.1***	***$2,947.6***	***$1,953.5***
Household SLR Costs	$26.4	$0.0	-$26.4	$26.4	$0.0	-$26.4
State Rule Implementation and Administration	$41.8	$67.6	$25.8	$41.8	$67.6	$25.8
Wastewater Treatment Plant Costs	$4.8	$5.1	$0.3	$4.8	$5.2	$0.4
Total Annual Rule Costs	**$1,067.1**	**$3,020.9**	**$1,953.8**	**$1,067.1**	**$3,020.4**	**$1,953.3**

Acronyms: CWS = community water system; LCRI = Lead and Copper Rule Improvements; SLR = service line replacement; PWS = public water system; United States dollar.
Notes: (1) Previous Baseline costs are projected over the 35-year period of analysis and are affected by the EPA's assumptions on three uncertain variables which vary between the low and high cost scenarios.
(2) Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

Exhibit 8-17: Estimated National Annual Benefit Comparison Between the Final LCRI and Alternative Small System Flexibility Option (Flexibility for CWSs Serving up to 10,000 Persons) - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Final Rule			Alternative Option (Small System Flexibility for CWSs Serving up to 10,000 Persons)		
	Baseline	**LCRI**	**Incremental**	**Baseline**	**LCRI**	**Incremental**
Annual IQ Benefits	$3,279.0	$10,963.0	$7,684.0	$3,279.0	$10,963.1	$7,684.1
Annual Low-Birth Weight Benefits	$1.8	$5.7	$3.9	$1.8	$5.7	$3.9
Annual ADHD Benefits	$179.9	$599.5	$419.6	$179.9	$599.5	$419.6
Annual Adult CVD Premature Mortality Benefits	$8,174.9	$25,210.0	$17,035.1	$8,174.9	$25,210.5	$17,035.6

	Final Rule			Alternative Option (Small System Flexibility for CWSs Serving up to 10,000 Persons)		
	Baseline	LCRI	Incremental	Baseline	LCRI	Incremental
Total Annual Benefits	**$11,635.6**	**$36,778.2**	**$25,142.6**	**$11,635.6**	**$36,778.8**	**$25,143.2**

Acronyms: ADHD = attention-deficit/hyperactivity disorder; CVD = cardiovascular disease; CWS = community water system; IQ = intelligence quotient; LCRI = Lead and Copper Rule Improvements; USD = United States dollar.
Note: Very small differences in results between the final rule and the regulatory option are due to inter-run variability in the SafeWater LCR model, and/or rounding, and should not be interpreted at true differences between the costs and benefits of the final rule and the alternative option.

8.9 Summary of Alternative Options Considerations

Exhibit 8-18 provides a summary of the estimated annualized monetized costs, benefits, and net benefits for the final LCRI and the alternative options considered in this chapter.

Exhibit 8-18: Estimated National Annualized Rule Cost, Benefit, and Net Benefit Comparison Between the Final LCRI and Alternative Options Considered - High Scenario - 2 Percent Discount Rate (millions of 2022 USD)

	Total Annualized Cost	Total Annualized Benefit	Net Benefit
Final LCRI	$ 1,953.8	$ 25,142.6	$ 23,188.8
Alternative Options Considered			
Action Level ≤ 0.015 mg/L	$ 1,840.5	$ 23,739.7	$ 21,899.2
Action Level ≤ 0.005 mg/L	$ 2,186.8	$ 27,700.9	$ 25,514.1
Service Line Replacement Rate = 7%	$ 1,904.7	$ 21,902.7	$ 19,998.0
Lead Connectors and Galvanized Lines Previously Downstream of Lead Connectors Must be Replaced	$ 2,125.2	$ 30,645.9	$ 28,520.7
Service Line Replacement Deferred Deadline with Additional Potential Maximum Rate of 10,000 SL Per Year	$ 1,952.9	$ 25,133.4	$ 23,180.5
Service Line Replacement Deferred Deadline with Additional Potential Maximum Rate of 8,000 SL Per Year	$ 1,951.9	$ 25,075.7	$ 23,123.8
Temporary Filters Made Available to Lead, GRR, and Unknown Lead Content Service Line Customers Only in Systems Meeting Multiple ALE Criteria	$ 1,926.3	$ 25,142.6	$ 23,216.3
Deliver Temporary Filters Directly to All Customers in Systems Meeting Multiple ALE Criteria	$ 1,959.6	$ 25,142.6	$ 23,183.0
Small System Flexibility for CWSs Serving up to 10,000 Persons	$ 1,953.3	$ 25,143.2	$ 23,189.9

Note: The EPA considered an alternative to the final LCRI's lead tap sampling standard monitoring requirements. The EPA's analysis of this alternative option found that the expected increase in sampling cost and potential increase in benefits associated with systems (non-lead/unknown and 100 percent unknown) taking earlier

corrective action as a result of ALEs were small and did not affect estimated nation annualized costs and benefits at the EPA $100,000 significant digit level. Therefore, the EPA did not present the estimated cost, benefit, and net benefit for this lead tap sampling alternative option.

The EPA's analysis of the alternative regulatory options found that the following options had estimated annual net benefits greater than the final LCRI: (1) setting the AL to 0.005 mg/L; (2) including lead connectors and galvanized service lines previously downstream of lead connectors in the definition of lead content requiring replacement; (3) requiring systems with multiple ALEs to make temporary filters available to households with lead, GRR, or unknown lead content service lines; and (4) allowing systems serving up to 10,000 persons the ability to utilize the small system compliance flexibility options. From a purely economic standpoint that would mean these four options are preferable to the final LCRI. However, three of these options were not selected, in place of the final rule, because of questionable technical feasibility. SDWA section 1412(b)(4)(D) says the term "feasible" means feasible with the use of the best technology, treatment techniques and other means which the Administrator finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available. The EPA has discussed the agency's feasibility concerns with regard to: setting the action level to 0.005 mg/L; including lead connectors and galvanized service lines previously downstream of lead connectors in the definition of lead content requiring replacement; and allowing systems serving up to 10,000 persons the ability to utilize the small system compliance flexibility options, in preceding sections of this preamble. Regarding setting the AL at a level below 0.010 mg/L, the EPA has expressed concern associated with feasibility. See section IV.F.4, of the final LCRI *Federal Register* notice (USEPA, 2024) for information on feasibility. When considering the inclusion of lead connectors and galvanized service lines previously downstream of lead connectors in the set of service lines that must be actively replaced, the EPA was concerned about how these activities might pull resources away from the removal of lead and GRR service lines that pose a greater exposure risk. See sections IV.B.2 and IV.O.3, of the final LCRI *Federal Register* notice (USEPA, 2024) for a detailed discussion. In the case of setting the threshold for the small system flexibility option to include systems serving up to 10,000 persons or fewer, despite the modeling results showing an increase net benefits under this option, the EPA finds that the complexity of implementing POU filtration at all residences in a system serving 3,300 to 10,000 individuals, or potentially 1,300 to 4,000 separate locations, cannot be correctly captured in the estimated cost structure within the economic model and makes this option infeasible. See section IV.I, of the final LCRI *Federal Register* notice (USEPA, 2024) for additional information on point-of-use feasibility. In addition, the monetized benefits associated with the implementation of CCT are known to be underestimated given the potential reductions in lead exposure at homes without lead and GRR service lines in a system implementing CCT which is not captured in the EPA benefit estimates. The CCT benefits also do not capture reduced water loss, plumbing repair cost, and water damage costs associated with the increased use of corrosion control. See section VI.F.2, of the final LCRI *Federal Register* notice (USEPA, 2024) for more information on the unquantified impacts. See section IV.F, of the final LCRI *Federal Register* notice (USEPA, 2024) for additional information on CCT. With regard to estimated annual net benefits being greater for the alternative option where systems with multiple ALEs would be required to only make temporary filters available to households with lead, GRR, or unknown lead content service lines, the EPA has highlighted the inability of the benefits analysis to monetize positive health impact from reduced lead exposure at non-lead and GRR service line locations which leads to an underestimate of final LCRI benefits relative to the benefits estimated for this alternative option. Note also that the EPA made a conservative costing assumption that 100 percent of households that are eligible to receive a

filter would pick-up a filter when made available. The EPA has very little information on what the actual pick-up rate may be but it is possible that the rate could be significantly less than 100 percent and therefore the costs for both the final LCRI and this alternative multiple ALE temporary filters program are overestimated, and given the fact that the final LCRI is making filters available to all households in a system its estimated costs are likely overestimated to a greater extent than the alternative option. Because of the similar annual estimated net benefits between the two alternatives, only $27.5 million in 2022 dollars, and the benefit and cost estimation uncertainties outlined above the EPA cannot rely on the relative size of the estimated net benefits in selecting between these options. Therefore, the EPA selected the final LCRI multiple ALE option because it protects individuals in systems with multiple ALEs that do not have lead, GRR, or unknown service lines, were as the alternative option while addressing most of the exposure issues in lead, GRR service line systems today does not cover systems with multiple ALEs and no lead, GRR, or unknown service lines. The alternative option will also effectively sunset as all unknowns are identified and lead and GRR service lines are replaced (13 years except for systems on approved differed deadlines) leaving consumers in systems with chronic ALEs and no lead or GRR service lines to be exposed to potentially high levels of lead coming from premise plumbing. The final rule addresses this issue into the future by requiring filters be made available to all customers in systems with multiple ALEs.

In the case of the alternative lead tap sample monitoring requirements that would have systems with unknown lead content service lines start standard six-month lead tap sampling at the LCRI compliance date, the EPA's monetized cost and benefit estimates were too close to conclusively determine if this alternative option or the final LCRI has greater net benefits. Due to the potentially high volume of systems required to start standard monitoring, the EPA did not select to move forward with this alternative lead tap sampling option. One concern is the ability of the States to handle the increased demands of overseeing the potentially large number of systems requiring sampling assistance during the compressed time period immediately following the rule compliance date. Another concern is that requiring systems with unknowns to start standard six-month lead tap sampling would affect a large number of small systems, as the EPA estimates that 45 percent of small systems, or 20,200 systems, have an inventory with unknown material service lines and no lead or GRR service lines. Lastly, the EPA considered a phased approach to include systems with unknowns in the standard monitoring requirements but decided that the complexity of a phased approach was not commensurate with the benefits, as nearly all systems will conduct monitoring within three years of the rule promulgation based on their LCR sampling schedule. See section IV.E, of the final LCRI Federal Register notice (USEPA, 2024) for additional information on lead tap sampling.

8.10 References

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