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Environmental Justice Analysis for Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category

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List of Abbreviations

ACS	American Community Survey
As-Cd-Pb	Arsenic-cadmium-lead
APS	Arizona Public Services
ASCC	Alaska Systems Coordinating Council
ATSDR	Agency for Toxic Substances and Disease Registry
BA	Bottom ash
BAT	Best available technology economically achievable
BCA	Benefit-cost analysis
BINWOE	Binary weight-of-evidence
BLL	Blood lead level
BMP	Best management practice
BPJ	Best professional judgement
BrO^-	Hypobromite
CAA	Clean Air Act
CBG	Census block group
CCR	coal combustion residuals
CDC	Centers for Disease Control and Prevention
CES	Consumer Expenditure Survey
CFR	Code of Federal Regulations
CO_2	carbon dioxide
COMID	common identifier
COPD	chronic obstructive pulmonary disease
CP	chemical precipitation
CRE	cancer risk estimate
CRL	combustion residual leachate
CWA	Clean Water Act
DBP	disinfection byproduct
D-FATE	Downstream Fate and Transport Equations
EA	environmental assessment
EAB	Environmental Appeals Board
ELGs	effluent limitations guidelines and standards
EJ	environmental justice
E.O.	Executive Order
EPA	Environmental Protection Agency
FCPP	Four Corners Power Plant
FGD	flue gas desulfurization
FRN	*Federal Register* Notice
GHG	greenhouse gas
GIS	geographic information system
HI	hazard index
HICC	Hawaii Coordinating Council

HQ	hazard quotient
HRR	high recycle rate systems
ICIS	Integrated Compliance Information System
IEUBK	integrated exposure uptake biokinetic
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Planning Model
IQ	intelligence quotient
IRW	immediate receiving water
JTA	Joint toxic action
LADD	Lifetime average daily dose
LECR	Lifetime excess cancer risk
LUEGU	Low-utilization electric generating unit
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal
MDA8	Maximum daily average 8-hour
Me-Hg-Pb	Methylmercury-lead
MRL	Minimal risk level
MRO	Midwest Reliability Organization
NA	Not applicable
NAACP	National Association for the Advancement of Colored People
NAAQS	National Ambient Air Quality Standards
NASEM	National Academies of Science, Engineering, and Medicine
NC DEQ	North Carolina Department of Environmental Quality
NEHC	no effect hazard concentration
NERC	North American Energy Reliability Corporation
NHDPlus	National Hydrography Dataset Plus
NO_x	nitrogen oxides
NPCC	Northeast Power Coordinating Council
NPDES	National Pollutant Discharge Elimination System
NRWQC	National Recommended Water Quality Criteria
NS	Not subcategorized
NTEC	Navajo Transitional Energy Company
OLEM	Office of Land and Emergency Management
OMB	Office of Management and Budget
OW	Office of Water
PFAS	Per- and polyfluoroalkyl substances
$PM_{2.5}$	Fine particulate matter
PSES	Pretreatment Standards for Existing Sources
PWS	Public water systems
PWSID	Public water system ID
RCRA	Resource Conservation and Recovery Act
RF	Reliability First Corporation
RfD	Reference dose
RIA	Regulatory impact analysis

SDWIS	Safe Drinking Water Information System
SERC	SERC Reliability Corporation
SI	Surface impoundment
SNAP	Supplemental Nutrition Assistance Program
SO_2	Sulfur dioxide
T3	Trophic level 3
T4	Trophic level 4
TDD	Technical development document
TDEQ	Texas Department of Environmental Quality
TEC	Threshold effect concentration
TRE	Texas Reliability Entity
THM	Trihalomethane
TMDL	Total maximum daily load
TTD	Target organ toxicity dose
TTHM	Total trihalomethanes
UCMR4	Fourth Unregulated Contaminant Monitoring Rule
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
USPS	U.S. Postal Service
WECC	Western Electricity Coordinating Council
ZCTA	Zip Code Tabulation Area
ZLD	Zero liquid discharge
Zn-Pb	Zinc-lead

Executive Summary

The U.S. Environmental Protection Agency (EPA) analyzed the distribution of water quality and non-water quality impacts of the final rule across all potentially affected communities and sought input from stakeholders representing communities with potential environmental justice (EJ) concerns. Several Executive Orders (E.O.s)—E.O. 12898, E.O. 13985, E.O. 14008, E.O. 12866, and E.O. 14096 – call on federal agencies to advance EJ and equity in developing policies by analyzing and addressing disproportionate and adverse impacts on historically underserved, marginalized, and economically disadvantaged people.

Under the authority of the Clean Water Act (CWA), EPA is finalizing revisions to the technology-based effluents limitations guidelines and standards (ELGs) for the steam electric power generating point source category for certain wastestreams. The ELGs address flue gas desulfurization (FGD) wastewater, bottom ash (BA) transport water, combustion residual leachate (CRL), and legacy wastewater at existing sources, and CRL at new sources.

As research has shown, steam electric power plants are often sited in low-income and communities of color, and as a result, these communities are often differentially exposed to and experience the health effects from pollution from steam electric power plants compared to the average community in the United States (Henneman et al., 2023; NAACP, 2012; Tessum et al., 2019; Thind et al., 2019). Therefore, understanding the socioeconomic characteristics of populations affected by steam electric plant discharges is necessary to effectively analyze whether vulnerable populations — like low-income and minority populations — may experience differential impacts under the baseline and to what extent the supplemental ELGs may mitigate, exacerbate, or create differential impacts to these populations relative to the baseline.[1] To accomplish this, EPA conducted a distributional analysis of pollutant exposures, health effects, and costs and benefits under the baseline and all three regulatory options across all potentially affected communities.

This report details the EJ analysis for the final rule. Following the approach used at proposal, the analysis is divided into several elements:

- A literature review of EJ concerns related to coal-fired power plants (Section 2).
- A national-level proximity analysis which EPA used as an initial assessment of the socioeconomic characteristics of affected communities living in proximity to steam electric power plants, surface waters receiving discharges from steam electric power plants, as well as affected communities served by drinking water systems intaking water from receiving waters of steam electric power plants (Section 3).
- A national-level analysis of the distribution of pollutant exposures and health effects across population groups of concern in all potentially affected communities under the baseline and

[1] EPA's Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (2016) defines the term disproportionate impacts as "differences in impacts or risks that are extensive enough that they may merit Agency action." The Guidance further notes that "In general, the determination of whether there is a disproportionate impact that may merit Agency action is ultimately a policy judgment which, while informed by analysis, is the responsibility of the decision maker. The terms difference or differential indicate an analytically discernible distinction in impacts or risks across population groups. It is the role of the analyst to assess and present differences in anticipated impacts across population groups of concern for both the baseline and proposed regulatory options, using the best available information (both quantitative and qualitative) to inform the decision maker and the public."

regulatory options (Section 4). The exposure pathways, pollutant exposures, and/or human impacts assessed include:

- Exposure to fine particulate matter ($PM_{2.5}$) and ozone from air pollution emitted by steam electric power plants.
- Water quality, wildlife, and non-cancer and cancer human health impacts from exposure to pollutants in immediate receiving waters of steam electric power plants.
- Human health impacts – neurological-, cardiovascular-, and cancer-related – caused by exposure to lead, mercury, and arsenic from consuming fish caught in reaches downstream of receiving waters of steam electric power plants.
- Exposure to total trihalomethanes (TTHM) in drinking water sources from drinking water systems that intake water from receiving waters of steam electric power plants, and the resulting incidence of bladder cancer cases and bladder cancer deaths.
- Health impacts from cumulative exposures to pollutants discharged by steam electric power plants through consumption of fish caught in immediate receiving waters of steam electric power plants.

- An analysis that evaluates the distribution of costs and benefits among potentially affected communities (Section 5).

Overall, EPA's EJ analysis showed that the extent to which the technologies steam electric power plants implement to control wastewater discharges will reduce differential baseline exposures for low-income populations and people of color in affected communities to pollutants in wastewater and resulting human impacts varies. In particular, benefits associated with improvements to water quality, wildlife, and human health resulting from reductions in pollutants in surface water will accrue to some low-income populations and people of color at a higher rate under some or all of the regulatory options, while, particularly for communities near immediate receiving waters, some population groups of concern may experience new or exacerbated distributional disparities under the final rule. Benefits associated with drinking water will accrue to people of color and low-income populations at a higher rate under the final rule. Remaining exposures, impacts, costs, and benefits analyzed either accrue at a higher rate to populations which are not people of color or low-income, accrue proportionately to all populations, or are small enough that EPA could not conclude whether changes in disproportionate impacts would occur. While the changes in GHGs attributable to the final rule are small compared to worldwide emissions, findings from peer-reviewed evaluations demonstrate that actions that reduce GHG emissions are also likely to reduce climate-related impacts on vulnerable communities, including low-income communities and communities of color.

1. Introduction

1.1 Steam Electric Power Generating Effluent Limitations Guidelines and Standards

Under the authority of the Clean Water Act (CWA), the U.S. Environmental Protection Agency (EPA) develops national wastewater discharge standards that apply to categories of industrial point source wastewater dischargers, referred to as effluent limitations guidelines and standards (ELGs). Developed for a specific industry, ELGs are technology-based standards that industrial point sources subject to them are required, by regulation, to meet. Standards for direct industrial dischargers are implemented through the National Pollutant Discharge Elimination System permits issued by states and EPA regional offices. Standards for indirect dischargers are implemented through EPA, state, or local pretreatment programs.

One of the categories of industrial wastewater dischargers subject to ELGs is the steam electric power generating point source category. This category covers power plants primarily engaged in the generation of electricity for distribution and sale and that use nuclear or fossil fuels (such as coal, oil, and natural gas) to heat water in boilers, which generates steam that drive turbines connected to electric generators. The plants generate wastewater in the form of chemical pollutants and thermal pollution (heated water) from their water treatment, power cycle, ash handling and air pollution control systems, as well as from coal piles, yard and floor drainage, and other miscellaneous wastes.

The steam electric ELG sets technology-based standards for wastewater discharges from these steam electric power plants. The steam electric rule was promulgated in 1974 and has been amended in 1977, 1978, 1980, 1982, 2015, and 2020. While EPA is currently revising the ELGs, permitting authorities are implementing the requirements contained in the 2015 rule and the 2020 rule.[2]

With this final rule, EPA is revising the technology-based ELGs for wastestreams from coal-fired plants, including flue gas desulfurization (FGD) wastewater, bottom ash (BA) transport water, combustion residual leachate (CRL), and legacy wastewater.

1.2 Environmental Justice

EPA analyzed the distribution of water quality and non-water quality impacts of the final rule across all potentially affected communities and sought input from stakeholders representing communities with potential environmental justice (EJ) concerns.

The analysis has been conducted alongside other non-statutorily required analyses, such as the Environmental Assessment (EA). It is intended to provide the public with a discussion of the potential distributional impacts of the final rule and input received from communities potentially experiencing differential impacts. The analysis does not form a basis or rationale for any of the actions EPA is finalizing in this rulemaking.

1.2.1 Executive Orders

EPA performed the analysis following guidance on EJ issues to federal agencies through several Executive Orders (E.O.s): Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations; Executive Order 13985: Advancing Racial Equity and Support for Underserved Communities through the Federal Government; Executive Order 14008: Tackling the Climate Crisis at Home and Abroad; and Executive Order 14096: Revitalizing Our Nation’s Commitment to

[2] For more information on the 2015 rule and the 2020 rule see https://www.epa.gov/eg/steam-electric-power-generating-effluent-guidelines.

Environmental Justice for All (Executive Order 12898, 1994; Executive Order 13985, 2021; Executive Order 14008, 2021; Executive Order 14096, 2023).

Each Federal agency must make the achievement of EJ part of its mission "by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." (p.1) Section 2-2 of E.O. 12898 (59 FR 7629, February 16, 1994) provides that each Federal agency must conduct its programs, policies, and activities that substantially affect human health or the environment in a manner that ensures such programs, policies, and activities do not have the effect of (1) excluding persons (including populations) from participation in; or (2) denying persons (including populations) the benefits of; or (3) subjecting persons (including populations) to discrimination under, such programs, policies, and activities because of their race, color, or national origin.

E.O. 14008 (86 FR 7619, February 1, 2021) calls on Federal agencies to make achieving environmental justice part of their missions "by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts." (p. 7629) It also declares a policy "to secure environmental justice and spur economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution and under-investment in housing, transportation, water and wastewater infrastructure and health care." (p. 7629) Under E.O. 13563 (76 FR 3821, January 21, 2011), Federal agencies may consider equity, human dignity, fairness, and distributional considerations, where appropriate and permitted by law. E.O. 14008 directs Federal agencies to develop programs, polices and activities to address the disproportionate health, environmental, economic, and climate impacts on disadvantaged, historically marginalized and overburdened communities. Similarly, E.O. 14096 (88 FR 25251, April 26, 2023) re-emphasizes the commitment of the Executive branch to include the achievement of environmental justice in the mission of each agency and to evaluate the impacts of regulations and other Federal activities on communities with environmental justice concerns. E.O. 14096 places a responsibility on Federal agencies to "identify, analyze, and address disproportionate and adverse human health and environmental effects (including risks) and hazards of Federal activities, including those related to climate change and cumulative impacts of environmental and other burdens with environmental justice concerns[.]" (p. 25253) Additionally, E.O. 14096 suggests improved environmental justice analyses through "disaggregating environmental risk, exposure, and health data by race, national origin, income, socioeconomic status, age, sex, disability, and other readily accessible and appropriate categories." (p. 25257) EPA has reflected this suggestion by disaggregating the following proximity and distributional analyses by income, race and, ethnicity.

1.2.2 Considering EJ in Regulatory Actions

The incorporation of EJ into EPA's rulemakings is guided by two Agency documents: (1) Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (U.S. EPA, 2016) and (2) Guidance on Considering Environmental Justice During the Development of Regulatory Action (U.S. EPA, 2015b). The Technical Guidance for Assessing Environmental Justice in Regulatory Analysis (U.S. EPA, 2016) establishes the expectation that regulatory analysts conduct the highest quality EJ analysis feasible in support of rulemakings, recognizing that what is feasible will be context-specific.

When assessing the potential for disproportionate and adverse health or environmental impacts of regulatory actions on historically underserved and overburdened communities, EPA aims to answer three broad questions:

1. Is there evidence of potential EJ concerns in the baseline (defined as the state of the world absent the regulatory action)? Assessing the baseline enables EPA to determine whether pre-existing disparities are associated with the pollutant(s) under consideration (*e.g.*, are the effects of the pollutant(s) more concentrated in some population groups?).

2. Is there evidence of potential EJ concerns for the regulatory option(s) under consideration? Specifically, how are the pollutant(s) and its (their) effects distributed for the regulatory options under consideration? And
3. Do the regulatory option(s) under consideration exacerbate or mitigate EJ concerns relative to the baseline?[3]

1.2.3 Definitions and Terminology

EPA defines EJ as the "just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other Federal activities that affect human health and the environment so that people:

> (i) are fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards, including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural or systemic barriers; and
>
> (ii) have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices." (Executive Order 14096, 2023).

EPA has also defined meaningful involvement based on four key principles: "people have an opportunity to participate in decisions about activities that may affect their environment and/or health; the public's contributions can influence the regulatory agency's decision; community concerns will be considered in the decision-making process; and decision makers will seek out and facilitate the involvement of those potentially affected" (Executive Order 12898, 1994). The OMB has issued additional guidance on including public participation and community engagement in the regulatory process across the federal government (OMB, 2023).

Throughout this document the terms "potential EJ concern" and "population group(s) of concern" are used:

A potential EJ concern is defined as "the actual or potential lack of fair treatment or meaningful involvement of minority populations,[4] low-income populations, Tribes, and Indigenous Peoples in the development, implementation, and enforcement of environmental laws, regulations, and policies" (U.S. EPA, 2016, p. 4). In a regulatory context, the term refers to "disproportionate impacts on minority populations, low-income populations, and/or Indigenous Peoples that may exist prior to or may be created by the proposed regulatory action" (U.S. EPA, 2016, p. 4). Therefore, this analysis uses the term when discussing whether the results of EPA's quantitative and qualitative analyses indicate that there are differential impacts under the baseline and/or regulatory options that could be considered disproportionate.

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[3] Differential impacts on population groups of concern can only be identified in relation to a comparison group. A comparison group can be defined in multiple ways, for instance in terms of individuals with similar socioeconomic characteristics located at a broader geographic level or with different socioeconomic characteristics within an affected area. The goal is to select a comparison group that allows one to identify how the effects of the regulation vary by race, ethnicity, and income separate from other systematic differences across groups or geographic areas.

[4] In relation to Executive Order (E.O.) 12898, the White House's Council on Environmental Quality defines minorities as "individual(s) who are members of the following population groups: American Indian or Alaska Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic" (U.S. Environmental Protection Agency. (2016). *Technical Guidance for Assessing Environmental Justice in Regulatory Analysis*. Retrieved from https://www.epa.gov/sites/default/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf, p. 6).

E.O. 12898 identified a number of population groups of concern including people of color, low-income populations, and Indigenous Peoples (E.O. 12898, 59 CFR 7629, February 16, 1994). E.O. 14096 expands populations groups of concern to include consideration of national origin and disability status (88 FR 25251, April 26, 2023). Populations who primarily consume fish and/or wildlife for subsistence are also included as a group that can overlap with other population groups of concern through unique exposure pathways to pollutants (E.O. 12898, 59 CFR 7629, February 16, 1994). EPA has also advised that, when appropriate, additional population characteristics–such as life stage and gender–can be used to evaluate differences within a population group of concern (U.S. EPA, 2016). The term is used in this analysis when referring to the apportionment of impacts among people of color, low-income populations, or Indigenous populations as well as individual racial/ethnic population groups (*e.g.*, Hispanic populations). (See Exec. Order No. 12866, 1993, p. 1; Exec. Order No. 12898, 1994; Exec. Order No. 13985, 2021, p. 7009; Exec. Order No. 14008, 2021, p. 7629; Exec. Order No. 14096, 2023, p. 25253; U.S. EPA, 2016, p. 4, 2022a)

1.3 Purpose and Outline of the Environmental Justice Analysis

EPA conducted this analysis to assess the distribution of pollutant exposures, environmental and human health impacts, and costs and benefits among populations expected to be affected by the revised ELGs.

To advance the objectives of E.O. 12898, the analysis evaluates the distribution of environmental and human health impacts under the baseline and regulatory options evaluated, giving particular attention to whether differential impacts that could be considered disproportionate and adverse are experienced by population groups of concern under the baseline and whether the regulatory options evaluated mitigate, exacerbate, or create differential impacts among population groups of concern. This analysis also advances the objectives of E.O.s 14008 and 14096 by evaluating, both quantitatively and qualitatively, some of the cumulative risks experienced by populations expected to be affected by the proposed rule. The distribution of these cumulative risks among population groups of concern is assessed under the baseline and regulatory options evaluated to determine whether the options mitigate, exacerbate, or create a differential distribution of cumulative risks among population groups of concern. Additionally, this analysis advances the objectives of E.O. 12866, as the costs and benefits of the options are evaluated with respect to the distribution of economic impacts among populations expected to be affected by the rule. Lastly, the analysis advances the objectives of E.O. 13985 by developing a more comprehensive approach to considering the equity of impacts of the final rule, using results from quantitative analyses to evaluate the distribution of environmental and human health impacts as well as results from qualitative information gathered through the meaningful involvement of affected populations. This involvement included public meetings EPA conducted with several affected communities during the development of the proposed rule (see proposed rule EJA document; U.S. EPA, 2023b), and the review of public comments EPA received on the proposed rule and considered as the Agency finalized the rule (see Response to Comments document in the docket for this action, U.S. EPA, 2024d).

The results of this EJ analysis are presented in the following sections of this document:

- Section 2 presents a review of existing literature on potential EJ concerns related to pollution from coal-fired power plants.
- Section 3 presents a nationwide assessment of the socioeconomic characteristics of communities living near steam electric power plants and exposure pathways for pollutants discharged by the plants.
- Section 4.1 defines the baseline and each of the regulatory options evaluated in the analysis.
- Sections 4.2 to 4.5 present EPA's evaluation of the distribution of environmental and/or human health impacts under the baseline and the regulatory options. The results are shown for each of the pollutant exposure pathways evaluated—air, surface water, and drinking water. This section also presents the results of the distribution of cumulative risks among populations expected to be affected by the revised ELGs.
- Section 5 discusses the distribution of benefits and costs of the final rule among affected populations.

- Section 6 discusses the limitations and uncertainties of the EJ analysis.
- Section 7 discusses the conclusions of the EJ analysis.
- Section 8 provides references cited in the text of the report.

Several appendices provide additional details on the analyses.

2. Literature on Potential Environmental Justice Concerns Associated with Coal-Fired Power Plants

EPA reviewed the available literature on EJ concerns related to coal-fired power plants, including additional studies published since the proposed rule. EPA identified 14 papers that focused on coal-fired power plants and EJ issues, eight of which focused on coal-fired power plants in the United States and were considered by the Agency to be directly relevant to the scope of the final rule. Two of the eight papers focused on a large study on coal-fired power plants conducted by the National Association for the Advancement of Colored People (NAACP);[5] one paper detailed the negative health consequences associated with living near coal-fired power plants; another paper explored inequalities in communities where coal-fired power plants are sited; three more papers focused explicitly on evaluating the disparate impacts of fine particulate matter ($PM_{2.5}$) pollution from coal power plants across income and race; and the eighth was a study conducted in a coal-producing region evaluating predictors of proximity to older coal waste impoundments. Additionally, EPA included a discussion of the results from a previous EPA EJ analysis on the disposal of coal combustion residuals from electric utilities to detail previously discovered EJ concerns related to coal-fired power plants. The findings of the literature review are discussed below.

Living near coal-fired power plants can be associated with adverse health impacts. These plants produce air pollutants like sulfur dioxide (SO_2), nitrogen oxides (NO_X), and $PM_{2.5}$. Exposures to SO_2 and NO_x are associated in the short-term with acute respiratory illnesses like coughing and wheezing, and in the long-term with asthma (Casey et al., 2020). Asthma has been found to particularly affect people who identify as African American. African Americans are three times more likely, on average, to be hospitalized for asthma than people who identify as White and have a death rate from asthma that is 172 percent higher than people who identify as White (NAACP, 2012). Additionally, exposure to $PM_{2.5}$ can cause chronic bronchitis, irregular heart conditions, and asthma, and lead to premature death among people with heart or lung disease (Thind et al., 2019). Coal-fired power plants also release heavy metals like mercury, uranium, arsenic, and lead into the air and water. Pregnant women and their children are particularly vulnerable to adverse health impacts from exposure to heavy metals, as in vitro exposures can cause developmental disorders in children like impaired brain function, blindness, and development delays in general (NAACP, 2012). Indigenous populations can also experience potentially disproportionate and adverse health impacts from exposure to heavy metals, particularly mercury, due to their higher rates of fish consumption (Israel & The Daily Climate, 2012). These findings suggest that people of color, Indigenous populations, and children face potentially disproportionate and adverse health impacts from exposures to pollutants released by coal-fired power plants into the air and water.

In 2012, the NAACP evaluated 378 coal-fired power plants in the United States based on their EJ performance (NAACP, 2012). A plant's EJ performance was determined using a scoring system based on five factors: emissions of SO_2, emissions of NO_X, size of the population living within three miles of the plant, median income of the total population living within three miles of the plant, and the percentage of people of color living within three miles of the plant (NAACP, 2012). The analysis showed that individuals living within three miles of a coal-fired power plant are on average poorer and more likely to be people of color (NAACP, 2012). Particularly, coal-fired power plants sited in urban areas are differentially located in communities of color (NAACP, 2012). Focusing on 75 plants that received "failing" EJ performance scores, the study found that the four million people living within three miles of these plants had an average per capita income of $17,500, or about $22,600 in 2022 dollars—about 25 percent less than the national

[5] While the universe of steam electric plants has changed substantially since the NAACP report was published, this report still provides relevant background on the potential health effects associated with living near steam electric plants as well as a history of EJ concerns surrounding steam electric plants.

average[6]—and 53 percent were people of color compared to a national average of 36 percent (NAACP, 2012).

NAACP (2012) also found that coal-fired power plants contribute to climate justice issues through emissions of carbon dioxide (CO2) which contribute to climate change. The report cited a statement made by EPA in 2009 that listed some of the impacts of climate change, including “increased drought, increased number of heavy downpours and flooding, more frequent and intense heat waves and wildfires, greater sea level rise, more intense storms, and harm to water resources, agriculture, wildlife, and ecosystems” (NAACP, 2012, p. 18). The report noted that certain populations - including low-income populations, Indigenous populations, people of color, elderly populations, and disabled populations - may face a potentially disproportionate risk from these climate change impacts, given that they generally have less capacity to recover from such events (NAACP, 2012). Based on these findings, coal-fired power plants may lead to potentially disproportionate risks among these population groups beyond those who live near a plant by increasing the likelihood of extreme weather and natural disasters in their communities.

While the current population of coal-fired power plants substantially differs from that evaluated in 2012 due to the conversion and retirement of coal-fired generating units in the last decade, more recent studies reached similar conclusions regarding the differential impacts of coal-fired power plants on certain populations. Kosmicki and Long (2016) empirically analyzed whether people of color and children are more likely to live near coal-fired power plants as well as if poverty and income level are indicators of proximity to a coal-fired power plant. The results of their multinomial logistic regression show that Census tracts with higher percentages of people of color and a lower median income have an increased probability of being located within ten miles of a coal-fired power plant. Similarly, Henneman et al. (2023) found that Black populations and Indigenous populations have been inequitably exposed to coal-fired power plant-related $PM_{2.5}$ emissions. In this study, the authors identified annual $PM_{2.5}$ source impacts associated with SO_2 emissions from US coal-fired power plants from 1999-2020. Although $PM_{2.5}$ emission exposure has fallen across the board, the authors found that Black populations and Indigenous populations are still inequitably exposed to this pollutant, particularly in the North Central and Western region of the US.

Similar to Henneman et al. (2023), Thind et al. (2019) and Tessum et al. (2019) evaluate the exposure of different population groups to $PM_{2.5}$ emissions from coal-fired power plants. Both studies allocate the burden of electricity production (as measured by the exposure to $PM_{2.5}$ emissions) by fuel used to produce electricity as well as how much electricity communities consume. Thind et al. (2019) found that around 93 percent of deaths attributable to $PM_{2.5}$ from electricity generation are attributable to coal-fired power plants. Additionally, the authors found that low-income households are exposed to $PM_{2.5}$ from electricity generation at a much higher rate than high-income households. Similarly, Tessum et al. (2019) found that Black and Hispanic populations are exposed to more $PM_{2.5}$ pollution from electricity generation relative to their consumption of electricity. These findings suggest that coal-fired power plants tend to be located in low-income communities, communities of color, and Indigenous communities.

Additionally, EPA conducted an EJ analysis to support the proposed rule for *Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Legacy CCR Surface Impoundments* (88 FR 31982). In that analysis, EPA found that Black populations, Native American populations, Hispanic populations, households below the poverty level, households with less than a high school education, and households experiencing linguistic isolation were more highly represented in the populations living within one and three miles of facilities with legacy coal combustion residual (CCR) surface impoundments than the national average (U.S. EPA, 2023). EPA also evaluated the cumulative environmental impacts of facilities with legacy CCR surface impoundments by observing the levels of certain environmental indicators, such as particulate matter (PM) 2.5, ozone, and diesel PM, among other indicators. EPA found that within a mile of facilities with legacy CCR surface impoundments, more than half of the environmental indicators observed were higher than the averages for the state where the

[6] Expressed in 2022 dollars, the average per capita income in the U.S. was about $28,300.

facility is located. From these findings, EPA concluded that the proposed rule would reduce potential disproportionate effects on the communities with EJ concerns by requiring closure and corrective actions at legacy facilities, reducing the risks of exposure to contaminants from CCR (U.S. EPA, 2023).

Though coal production is not directly addressed by the revised ELG, EJ concerns have also been studied in coal-producing areas. Since the decline in the coal industry and in the aftermath of the Martin County, Kentucky coal waste impoundment disaster, Liévanos, Greenberg and Wishart (2018) found that the strongest predictors of proximity to older coal waste impoundments were proximity to abandoned and sealed mines and poverty levels. Particularly with poverty, the study found that a one percent increase in the percent of block group residents living below the poverty line is associated with a 52-meter decrease in distance to the nearest coal waste impoundment sited from 2001 to 2006 (Liévanos, Greenberg & Wishart, 2018). Based on this finding, they concluded that "block group poverty levels consistently represented the path of least resistance to new hazardous coal waste impoundments sited" within that period (Liévanos, Greenberg & Wishart, 2018, p. 51). This suggests EJ concerns among low-income populations in coal-producing areas with respect to the siting of new coal waste impoundments and increased risks of potential disproportionate and adverse impacts as impoundments age and become more susceptible to failure.

3. Nationwide Proximity Analysis

EPA conducted a nationwide proximity analysis to identify and characterize communities near steam electric power plants subject to the revised ELGs, downstream surface waters affected by plant discharges, and communities served by drinking water systems potentially affected by plant discharges. The methodology follows the same approach EPA used for the proposed rule, but with updated socioeconomic data and set of affected steam electric power plants and the associated receiving and downstream reaches.

3.1 Socioeconomic Characteristics of Populations Residing in Proximity to Steam Electric Power Plants

For this analysis, EPA assessed the socioeconomic characteristics of the populations within specified distances of steam electric power plants and of immediate reaches affected by steam electric plant discharges. EPA conducted this analysis for the set of 112 steam electric power plants for which the Agency modeled non-zero pollutant loadings under the baseline or regulatory options.

EPA collected 2017 to 2021 population-specific American Community Survey (ACS) data from the U.S. Census Bureau (2022a) on:

- The percent of the population below the poverty threshold,[7] referred to as "low-income population" in this analysis.
- The percent of the population categorized in various racial/ethnic groups representing people of color.[8]

EPA compiled these data for Census block groups (CBGs) located within one mile and three miles of steam electric power plants. EPA assessed the spatial distribution of low-income individuals and specific race and ethnicity categories to determine whether people in these groups are more or less represented in the populations living near steam electric power plants that are expected to incur costs because of the rule.[9] Additionally, there are plants included in this analysis that are not expected to incur costs because of the rule but do have non-zero baseline loads for the four waste streams in the final rule. EJ concerns may exist in areas where the percent of the population that is low-income and/or people of color is higher than the state or national averages.

The distance buffers from the steam electric power plants and their associated immediate receiving reaches[10] are denoted below as the "analysis region." Populations within the regions included in the analysis may be affected by steam electric power plant discharges and other environmental impacts in the immediate vicinity of the plant in the baseline and by environmental improvements resulting from the regulatory options.[11] EPA notes that these are not the only populations that could be affected by steam

[7] For the ACS, the Census Bureau determines poverty status by comparing annual income to a set of dollar values, called poverty thresholds, that vary by family size, number of children, and the age of the householder.

[8] The racial/ethnic categories are based on available fish consumption data as well as the breakout of racial/ethnic populations in Census data, which distinguishes racial groups within Hispanic and non-Hispanic categories.

[9] In this analysis, EPA used the coordinates of each steam electric plant as the basis to define analysis regions using various distance buffers.

[10] The regulatory options are projected to result in reductions (or no change) in pollutant loadings discharged to receiving waters; therefore, changes are generally anticipated to benefit populations living near the plants.

[11] Throughout this discussion, unless stated otherwise, changes are in the direction of improving environmental conditions.

electric power plants and other environmental impacts. For example, air pollutants emitted by steam electric power plants may affect populations within hundreds of miles of that plant.

EPA used the U.S. Census Bureau's ACS data for 2017 to 2021 (U.S. Census Bureau, 2022a) to identify and income status at the CBG, analysis region, state, and national levels. Table 1 summarizes the socioeconomic characteristics of the analysis regions defined using buffer distances of one and three miles from the steam electric power plants. As shown in Table 1, approximately 90,000 people live within one mile of at least one steam electric power plant that is expected to incur compliance costs due to the final rule or has a non-zero load for any of the four waste streams considered in the final rule, and approximately 790,000 people live within three miles.[12] For communities located within one and three miles of a steam electric power plant, the proportion of the population that are people of color (considered as a group, across all racial/ethnic categories) or is smaller than or similar to the national average, with the exception of people who identify as American Indian or Alaska Native (non-Hispanic) and those who identify as Other (non-Hispanic). These racial/ethnic categories have proportions that are larger than the national average (Table 1).

The comparison to the national average does not account for important differences between states, particularly given the non-uniform geographical distribution of steam electric power plants across the country. Therefore, EPA also compared the demographic characteristics of communities around each plant to that of the states intersected by each analysis region. Table 2 summarizes the state statistics against which the communities around each plant were compared.

Steam electric power plants expected to incur compliance costs due to the final rule or that have a non-zero load for any of the four waste streams considered in the final rule are located in 30 states across the U.S. Across these states, EPA observed great variability in the percent of states' populations identified as people of color or low-income. For example, across the 30 states, the percent of the states' populations identified as African American (non-Hispanic) ranges from 0.8 to 37.4 percent (Table 2). Because of this, EPA compared the results from Table 1 to the median of the state averages for each demographic characteristic. For communities within one and three miles of a steam electric power plant identified as belonging to the demographic groups analyzed, population proportions exceeded the median of the state averages, except for people identified as low-income, Native Hawaiian/Pacific Islander (non-Hispanic), and Hispanic/Latino (within one mile of a plant only) (Table 2).

[12] For both buffer distances, around one percent of CBGs fall within the buffer area around multiple steam electric plants. As a result, some individuals may be double counted in this estimation of total affected population.

Table 1. Percent of the Population Living Within 1 and 3 Miles of a Steam Electric Power Plant and Associated Immediate Receiving Reach Identifying as A Person of Color or Low-Income, Compared to the General Population

Distance from Plant	Total Population (Millions)[a]	Percent Low-Income	Percent African American (Non-Hispanic)	Percent Asian	Percent Native Hawaiian/Pacific Islander	Percent American Indian/Alaska Native	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
1 mile	0.09	12.2%	11.3%	3.1%	0.0%	0.9%	4.5%	5.9%
3 miles	0.79	13.0%	10.5%	2.7%	0.0%	0.9%	3.9%	8.0%
United States	333.0	12.9%	12.1%	5.6%	0.2%	0.6%	3.5%	19.2%

Source: U.S. EPA analysis, 2024.

Notes:

a. For both buffer distances, around one percent of CBGs fall within the buffer area around multiple steam electric plants.

Table 2. Socioeconomic Characteristics of States with Communities Potentially Affected by Steam Electric Plant Discharges, Compared to the National Average

State	Percent Below Poverty Level	Percent African-American (Non-Hispanic)	Percent Asian (Non-Hispanic)	Percent Native Hawaiian/Pacific Islander (Non-Hispanic)	Percent American Indian/Alaska Native (Non-Hispanic)	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
AL	15.8%	26.3%	1.4%	0.0%	0.3%	2.5%	4.5%
AR	16.0%	15.2%	1.5%	0.3%	0.5%	4.0%	7.9%
FL	13.1%	15.1%	2.7%	0.1%	0.1%	3.2%	26.2%
GA	13.9%	31.1%	4.2%	0.0%	0.1%	3.2%	9.9%
IA	11.0%	3.7%	2.5%	0.1%	0.2%	2.8%	6.4%
IL	11.8%	13.8%	5.6%	0.0%	0.1%	2.7%	17.5%
IN	12.5%	9.3%	2.4%	0.0%	0.1%	3.0%	7.3%
KS	11.5%	5.4%	3.0%	0.1%	0.5%	3.9%	12.3%
KY	16.3%	7.9%	1.5%	0.1%	0.1%	2.8%	3.9%
LA	18.8%	31.7%	1.7%	0.0%	0.5%	2.9%	5.3%
MI	13.3%	13.4%	3.2%	0.0%	0.4%	3.6%	5.4%
MN	9.2%	6.5%	5.0%	0.0%	0.8%	3.7%	5.6%
MO	12.8%	11.2%	2.0%	0.1%	0.2%	3.8%	4.4%

Table 2. Socioeconomic Characteristics of States with Communities Potentially Affected by Steam Electric Plant Discharges, Compared to the National Average

State	Percent Below Poverty Level	Percent African-American (Non-Hispanic)	Percent Asian (Non-Hispanic)	Percent Native Hawaiian/Pacific Islander (Non-Hispanic)	Percent American Indian/Alaska Native (Non-Hispanic)	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
MS	19.4%	37.4%	1.0%	0.0%	0.4%	2.0%	3.2%
NC	13.7%	20.8%	3.0%	0.1%	1.0%	3.3%	9.8%
ND	10.7%	3.1%	1.6%	0.2%	4.8%	3.1%	4.1%
NE	10.3%	4.7%	2.5%	0.1%	0.7%	3.0%	11.5%
NH	7.4%	1.4%	2.7%	0.0%	0.1%	2.8%	4.1%
NM	18.3%	1.8%	1.5%	0.1%	8.5%	2.5%	49.6%
OH	13.4%	12.2%	2.3%	0.0%	0.1%	3.5%	4.1%
OK	15.2%	7.1%	2.2%	0.2%	7.2%	7.9%	11.2%
PA	11.8%	10.5%	3.5%	0.0%	0.1%	3.0%	7.9%
SC	14.5%	26.0%	1.6%	0.1%	0.2%	2.9%	6.0%
TN	14.3%	16.3%	1.8%	0.1%	0.2%	2.9%	5.8%
TX	14.0%	11.8%	5.0%	0.1%	0.2%	2.5%	39.8%
UT	8.8%	1.1%	2.3%	0.9%	0.8%	3.2%	14.4%
VA	9.9%	18.7%	6.7%	0.1%	0.2%	4.1%	9.8%
WA	10.0%	3.7%	8.9%	0.6%	0.9%	6.1%	13.2%
WI	10.7%	6.2%	2.8%	0.0%	0.7%	2.9%	7.2%
WV	16.9%	3.4%	0.8%	0.0%	0.1%	2.8%	1.7%
WY	10.7%	0.8%	0.9%	0.1%	2.0%	3.0%	10.3%
Median State Average	13.1%	6.5%	2.1&	0.1%	0.2%	2.8%	6.6%
United States	12.9%	12.1%	5.6%	0.2%	0.6%	3.5%	19.2%

Source: U.S. EPA analysis, 2024.

3.2 Socioeconomic Characteristics of Populations Served by Affected Drinking Water Systems

In addition to considering proximity to steam electric power plants, EPA assessed the socioeconomic characteristics of communities served by public water systems (PWS) whose source waters are affected by steam electric power plant discharges. To do this, EPA estimated reductions in pollutant concentrations in PWS source waters affected by steam electric power plants' discharges, and characterized the populations served by the PWS directly or indirectly affected by these changes.

EPA determined the service area of each PWS using a multi-tiered approach based on data availability. EPA first used service areas identified in the Hydroshare Community Water Systems Service Boundaries (CWSSB) dataset (SimpleLab EPIC, 2022),[13] then 2022 TIGER ZIP code tabulated areas (ZCTAs), and finally county boundaries when no other data were available.[14] Over 95 percent of PWS with facilities downstream from steam electric plants had boundaries defined in the CWSBB dataset. Three percent of the PWS service areas were matched based on the ZIP code, and approximately one percent were matched based on the county. This approach to estimating service area boundaries differs from the approach used for the proposed rule, in that it relies primarily on the CWSSB dataset, which provides a more accurate estimate of service area boundaries than using just ZCTAs and county boundaries as was done in the proposed rule.

As with the proximity analysis for communities near steam electric power plants, EPA collected 2017 to 2021 population-specific ACS data from the U.S. Census Bureau (2022a) on:

- The percent of the population below the poverty threshold,[15] referred to as "low-income population" for this analysis.
- The population categorized in various racial/ethnic groups representing people of color.[16]

EPA conducted the analysis at the Census block group (CBG) level and compared the socioeconomic characteristics of the affected BGs (based on the service areas of affected PWS) to those of the state containing each CBG (U.S. Census Bureau, 2022b). EJ concerns may exist in areas where the share of the population that is low-income and/or minority (including specific racial or ethnic categories) is higher than the respective state average.

As Table 3 summarizes the socioeconomic characteristics of the estimated population potentially affected by changes in drinking water quality resulting from changes in pollutant levels in source waters.

[13] The CWSSB dataset uses a 3-tiered approach to assign more specific boundaries to PWS service areas. Tier 1 includes all PWS with explicit water service boundaries provided by states. Tier 2 assigns a boundary based on a match with a TIGER place name. Any PWS not in tier 1 or 2 is assigned a circular boundary around provided water system centroids based on a statistical model trained on explicit water service boundary data.

[14] This is compared to the 2019 and 2023 analyses which used counties and ZIP codes, respectively, to determine the demographic and socioeconomic characteristics of the population served.

[15] For the ACS, the Census Bureau determines poverty status by comparing annual income to a set of dollar values, called poverty thresholds, that vary by family size, number of children, and the age of the householder.

[16] The racial/ethnic categories are based on available fish consumption data as well as the breakout of ethnic/racial populations in Census data, which distinguishes racial groups within Hispanic and non-Hispanic categories. The groups are: African American (non-Hispanic), Asian (non-Hispanic), Native Hawaiian or Pacific Islander (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino.

Table 3. Socioeconomic Characteristics of Populations Served by Potentially Affected PWS, Compared to the National Average

State	Number of Potentially Affected PWS	Population Served[a]	Socioeconomic Characteristics of Populations in Service Areas of Affected PWS						
			Percent Below Poverty Level	Percent African-American (Non-Hispanic)	Percent Asian (Non-Hispanic)	Percent Native Hawaiian/Pacific Islander (Non-Hispanic)	Percent American Indian/Alaska Native (Non-Hispanic)	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
AL	51	1,243,009	14.4%	21.2%	1.3%	0.0%	0.4%	3.2%	6.4%
AR	18	20,567	16.5%	0.4%	0.2%	0.1%	1.9%	3.3%	2.7%
DE	1	231,114	12.0%	24.8%	5.2%	0.0%	0.1%	3.4%	11.9%
FL	7	429,167	9.5%	5.6%	1.8%	0.0%	0.2%	2.3%	10.6%
GA	16	706,206	18.0%	31.0%	1.9%	0.1%	0.1%	3.2%	11.5%
IA	12	155,987	13.9%	3.6%	1.0%	0.3%	0.2%	2.8%	9.6%
IL	86	759,693	13.4%	17.8%	1.4%	0.0%	0.1%	3.7%	4.4%
IN	4	192,275	15.7%	10.5%	1.4%	0.2%	0.0%	3.3%	2.9%
KS	21	781,859	9.2%	5.0%	4.6%	0.0%	0.6%	3.7%	7.8%
KY	54	1,774,744	16.9%	16.2%	2.1%	0.0%	0.1%	3.5%	4.9%
LA	4	89,699	17.5%	25.8%	2.0%	0.0%	0.4%	3.0%	7.8%
MA	12	397,487	11.5%	3.9%	9.7%	0.0%	0.1%	2.7%	26.3%
MD	20	2,140,060	16.8%	47.9%	4.5%	0.0%	0.2%	3.8%	6.4%
MI	99	3,426,543	17.0%	28.5%	4.6%	0.0%	0.2%	3.6%	5.5%
MN	11	1,055,600	14.8%	15.7%	10.4%	0.0%	0.7%	5.1%	8.9%
MO	52	2,658,501	9.3%	17.4%	6.0%	0.1%	0.2%	3.5%	5.1%
MS	2	1,490	19.4%	27.8%	2.7%	0.0%	0.0%	3.3%	8.2%
NC	38	1,514,192	10.8%	27.9%	5.4%	0.0%	0.2%	3.4%	11.9%
ND	13	33,722	8.1%	1.0%	0.8%	0.1%	3.2%	1.8%	3.4%
NE	13	569,432	15.3%	15.4%	4.4%	0.0%	0.5%	4.2%	12.5%
NH	3	103,592	7.1%	1.6%	3.6%	0.0%	0.1%	3.1%	10.7%
OH	30	1,229,857	17.9%	22.3%	2.0%	0.0%	0.0%	3.8%	3.9%
OK	48	828,052	13.6%	8.8%	3.2%	0.1%	6.8%	8.3%	12.1%
PA	93	4,033,477	10.3%	11.7%	4.1%	0.0%	0.1%	3.4%	4.7%
SC	72	1,496,142	14.6%	27.7%	1.9%	0.2%	0.2%	3.1%	6.1%
SD	45	43,674	14.6%	1.5%	1.9%	0.0%	19.6%	2.0%	3.2%
TN	43	2,116,969	11.4%	14.5%	2.8%	0.1%	0.1%	3.7%	7.2%
TX	1	23,170	14.6%	5.6%	5.8%	0.0%	0.1%	2.3%	16.0%

Table 3. Socioeconomic Characteristics of Populations Served by Potentially Affected PWS, Compared to the National Average

State	Number of Potentially Affected PWS	Population Served[a]	Socioeconomic Characteristics of Populations in Service Areas of Affected PWS						
			Percent Below Poverty Level	Percent African-American (Non-Hispanic)	Percent Asian (Non-Hispanic)	Percent Native Hawaiian/Pacific Islander (Non-Hispanic)	Percent American Indian/Alaska Native (Non-Hispanic)	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
VA	23	828,925	11.0%	26.5%	5.3%	0.1%	0.2%	5.0%	8.2%
WV	24	289,810	20.0%	4.6%	1.8%	0.0%	0.1%	3.8%	2.1%
TOTAL	916	29,175,015							
United States			12.9%	12.1%	5.6%	0.2%	0.6%	3.5%	19.2%

Source: U.S. EPA Analysis, 2024.

Notes:

a. The affected population is based on the total population served reported by SDWIS for affected PWSs within each state

As Table 3 shows, more than 29 million people across 30 states are served by PWSs potentially affected by the estimated changes in source water quality under the regulatory options. Of the 30 states with affected PWS, 19 serve CBGs with higher proportions of low-income populations, 17 serve CBGs with higher proportions of African American (non-Hispanic) populations, and 11 serve CBGs with higher proportions of Other (non-Hispanic) populations compared to the national average. Fewer than five of the states serve CBGs with higher proportions of American Indian or Alaska Native (non-Hispanic), Native Hawaiian or Pacific Islander (non-Hispanic), and Hispanic or Latino populations compared to the national average.

Table 4 and Table 5 summarize the estimated Tribal area population potentially affected by changes in drinking water quality as a result of steam electric power plant discharges. The analysis intersected the geographic boundaries of national Tribal lands with the service area boundaries of affected PWSs. This was then overlaid with CBGs. This analysis compares the socioeconomic characteristics of the affected Tribal areas to the averages of the states where the Tribal lands are located, the national average of the rural population of the United States, and the overall national average of the United States.

Table 4. Percent of Population in Tribal Areas with an Affected PWS Identifying as Low-Income Compared to Their Respective State, National Rural, and National Average

Tribal Area	States with Affected Tribal Areas	Total Population			Percent Low-Income Population	
		Affected Population[a]	Total for Tribal Area	State(s) Population	Tribal Area	State Average
Poarch Creek Reservation and Off-Reservation Trust Land	AL	9,930	440	4,876,863	8.2%	15.8%
Lake Traverse Reservation and Off-Reservation Trust Land	SD	230	11,409	881,785	27.9%	12.5%
Standing Rock Reservation	SD, ND	7,745	7,974	1,655,129	29.9%	11.6%
Prairie Band of Potawatomi Nation Reservation	KS	2,500	1,475	2,932,099	11.1%	11.5%
Cherokee OTSA	OK	638,430	513,176	3,948,136	16.0%	15.2%
Creek OTSA	OK	692,049	809,447	3,948,136	14.3%	15.2%
Osage Reservation	OK	511,302	46,140	3,948,136	16.7%	15.2%
Choctaw OTSA	OK	1,075	226,644	3,948,136	20.1%	15.2%
United States – Rural						**12.3%**
United States						**12.9%**

Source: *U.S. EPA analysis, 2024*.

Notes:

a. The affected population is based on the population served by the PWS. In some cases, the PWS serves both the tribal area and surrounding service areas.

Table 5. Percent of Population in Tribal Areas with an Affected PWS Identifying as a Racial or Ethnic Minority Compared to Their Respective State, National Rural, and National Average

Tribal Area	States	Total Population			Percent African American (Non-Hispanic)		Percent Asian (Non-Hispanic)		Percent Native Hawaiian / Pacific Islander (Non-Hispanic)		Percent American Indian/Alaska Native (Non-Hispanic)		Percent Other (Non-Hispanic)		Percent Hispanic/Latino	
		Affected Pop.[a]	Tribal Area	State(s) Pop.	Tribal	State Average (Avg.)	Tribal	State Avg.	Tribal	State Avg.	Tribal	State Avg.	Tribal	State Avg.	Tribal	State Avg.
Poarch Creek Reservation and Off-Reservation Trust Land	AL	9,930	440	4,876,863	0.4%	26.3%	0.0%	1.4%	0.0%	0.0%	0.0%	0.3%	9.7%	2.5%	0.0%	4.5%
Lake Traverse Reservation and Off-Reservation Trust Land	SD	230	11,409	881,785	0.0%	2.1%	0.3%	1.4%	0.0%	0.1%	44.9%	8.0%	1.9%	3.3%	1.7%	4.3%
Standing Rock Reservation	SD, ND	7,745	7,974	1,655,129	0.0%	2.6%	0.0%	1.5%	0.0%	0.1%	90.7%	6.5%	1.2%	3.2%	0.1%	4.2%
Prairie Band of Potawatomi Nation Reservation	KS	2,500	1,475	2,932,099	0.2%	5.4%	0.5%	3.0%	0.1%	0.1%	26.2%	0.5%	7.6%	3.9%	9.4%	12.3%
Cherokee OTSA	OK	638,430	513,176	3,948,136	10.7%	7.1%	3.0%	2.2%	0.1%	0.2%	7.3%	7.2%	8.2%	7.9%	13.5%	11.2%
Creek OTSA	OK	692,049	809,447	3,948,136	10.5%	7.1%	3.5%	2.2%	0.1%	0.2%	5.0%	7.2%	7.9%	7.9%	13.4%	11.2%
Osage Reservation	OK	511,302	46,140	3,948,136	12.7%	7.1%	3.3%	2.2%	0.1%	0.2%	5.0%	7.2%	7.9%	7.9%	15.1%	11.2%
Choctaw OTSA	OK	1,075	226,644	3,948,136	1.1%	7.1%	0.5%	2.2%	0.0%	0.2%	18.2%	7.2%	11.9%	7.9%	2.7%	11.2%
United States – Rural						**6.3%**		**0.7%**		**0.1%**		**1.8%**		**2.8%**		**7.4%**
United States						**12.1%**		**5.6%**		**0.2%**		**0.6%**		**3.5%**		**19.2%**

Source: U.S. EPA analysis, 2024.

Notes:

a. The affected population is based on the population served by the PWS. In some cases, the PWS serves both the tribal area and surrounding service areas.

As shown in Table 4, affected Tribal areas consistently have higher proportions of people who are below the poverty level compared to both the overall and rural national averages as well as the state averages, with the exception of the Prairie Band of Potawatomi Nation Reservation. As shown in Table 5, affected Tribal areas have higher proportions of people who belong to some minority racial/ethnic categories other than American Indian/Alaska Native (non-Hispanic) compared to state and national averages. In particular, the Poarch Creek Reservation and Off-Reservation Trust Land has nearly three times the proportion of people who identify as "Other (non-Hispanic)" than the state and national averages.

3.3 Socioeconomic Characteristics of Populations Affected by Changes in Exposure to Pollutants in Downstream Surface Waters

Lastly, EPA evaluated the socioeconomic characteristics of communities within 50 miles[17] of reaches affected by steam electric plant discharges, including both reaches that receive discharges from steam electric power plants and downstream reaches.[18] To assess the socioeconomic characteristics of these communities, EPA collected 2017 to 2021 population-specific ACS data (U.S. Census Bureau, 2022a) on:

- The percent of the population below the poverty threshold,[19] referred to as "low-income population" in this analysis.
- The population categorized in various racial/ethnic groups representing people of color.[20]

EPA compared the socioeconomic characteristics of these areas to national averages. EJ concerns may exist in areas where the percent of the population that is low-income and/or people of color (including specific racial or ethnic categories) is higher than the national average.

EPA conducted this analysis for communities affected by changes in pollutant loadings modeled for two periods: Period 1 and Period 2. Period 1 covers the years 2025 through 2029, when the universe of steam electric power plants would transition from current (baseline) treatment practices to practices that achieve the revised limitations, whereas Period 2 covers the years 2030 through 2049, when the full universe of plants is projected to employ treatment practices that achieve the revised limitations. The Benefit Cost Analysis (BCA) document provides additional details on the estimated loading reductions for the two periods (U.S. EPA, 2024a). Given that the results of the proximity analysis show similar water quality improvement and distributions in socioeconomic characteristics among affected communities in Period 1 and Period 2, with only differences in magnitude, results are only presented and discussed for Period 2 (Table 6 through Table 8).[21]

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[17] See the 2024 BCA for an explanation of why a 50-mile radius was used to estimate the potentially affected population.

[18] The analysis defines "communities in proximity to reaches" as the aggregate populations residing in CBGs within 50 miles of all reaches within 300 km of steam electric power plant outfalls with nonzero loadings, which includes approximately 112.5 million people as of 2021. This analysis provides total population and does not adjust for the fraction of this population that consumes self-caught fish.

[19] For the ACS, the Census Bureau determines poverty status by comparing annual income to a set of dollar values, called poverty thresholds, that vary by family size, number of children, and the age of the householder.

[20] The racial/ethnic categories are based on available fish consumption data as well as the breakout of ethnic/racial populations in Census data, which distinguishes racial groups within Hispanic and non-Hispanic categories. The groups are: African American (non-Hispanic), Asian (non-Hispanic), Native Hawaiian or Pacific Islander (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino.

[21] Results for Period 1 can be found in Appendix A.

Table 6. Percent of the Population Living Within 50 Miles of an Affected Downstream Reach with Modeled Concentrations of Selected Pollutants Under the Regulatory Options Compared to the National Average (Period 2)

Pollutant	Changes in Concentrations	Number of Downstream Reaches[a]			Percent Low-Income Population		
		Option A	Option B	Option C	Option A	Option B	Option C
Antimony	Decreases[b]	10,777	10,803	10,868	12.85%	12.85%	12.85%
	No changes	91	65	0	11.92%	11.48%	0.00%
Arsenic	Decreases	10,777	10,803	10,868	12.85%	12.85%	12.84%
	No changes	262	236	171	12.53%	12.43%	12.79%
Cadmium	Decreases	10,777	10,803	10,868	12.85%	12.85%	12.84%
	No changes	262	236	171	12.53%	12.43%	12.79%
Cyanide[a]	Decreases	3,667	3,667	4,107	13.53%	13.53%	13.48%
	No changes	440	440	0	13.13%	13.13%	0.00%
Lead[a]	Decreases	6,723	6,723	6,743	12.45%	12.45%	12.45%
	No changes	652	652	632	12.99%	12.99%	12.99%
Manganese	Decreases	10,777	10,803	10,868	12.85%	12.85%	12.84%
	No changes	262	236	171	12.53%	12.43%	12.79%
Mercury	Decreases	10,777	10,803	10,868	12.85%	12.85%	12.84%
	No changes	262	236	171	12.53%	12.43%	12.79%
Thallium	Decreases	10,777	10,803	10,868	12.85%	12.85%	12.84%
	No changes	262	236	171	12.53%	12.43%	12.79%
United States							**12.90%**

Source: U.S. EPA Analysis, 2024.

Notes:

a. Not all steam electric plants discharge cyanide and lead. The associated socioeconomic characteristic information is only for the set of reaches with non-zero loadings for those pollutants (4,107 and 6,743 reaches for cyanide and lead, respectively, compared to 10,868 reaches for other pollutants).

b. Under the regulatory options, the largest change in the concentration of the pollutants analyzed is a decrease in Manganese of 0.361 mg/L. Given the small range of pollutant changes observed–zero mg/L to -0.361 mg/L, EPA generalized these changes as "decreases" for each pollutant for ease of comprehension.

Table 7. Percent of the Population Living Within 50 Miles of an Affected Downstream Reach with Modeled Concentrations of Selected Pollutants Under the Regulatory Options Identifying as a Racial or Ethnic Minority Compared to the National Average (Period 2)

Pollutant	Changes in Concentrations	Number of Downstream Reaches[a]			Percent African American			Percent American Indian/ Alaska Native			Percent Asian		
		Option A	Option B	Option C	Option A	Option B	Option C	Option A	Option B	Option C	Option A	Option B	Option C
Antimony	Decreases[b]	10,777	10,803	10,868	15.52%	15.53%	15.48%	0.41%	0.41%	0.41%	3.66%	3.66%	3.65%
	No changes	91	65	0	9.31%	5.66%	0.00%	0.08%	0.05%	0.00%	1.73%	1.77%	0.00%
Arsenic	Decreases	10,777	10,803	10,868	15.49%	15.51%	15.45%	0.41%	0.41%	0.41%	3.68%	3.68%	3.67%
	No changes	262	236	171	13.98%	13.19%	16.04%	0.13%	0.13%	0.16%	2.07%	2.09%	2.22%
Cadmium	Decreases	10,777	10,803	10,868	15.49%	15.51%	15.45%	0.41%	0.41%	0.41%	3.68%	3.68%	3.67%
	No changes	262	236	171	13.98%	13.19%	16.04%	0.13%	0.13%	0.16%	2.07%	2.09%	2.22%
Cyanide[a]	Decreases	3,667	3,667	4,107	17.10%	17.10%	18.06%	0.21%	0.21%	0.21%	3.39%	3.39%	3.33%
	No changes	440	440	0	24.99%	24.99%	0.00%	0.20%	0.20%	0.00%	2.93%	2.93%	0.00%
Leada	Decreases	6,723	6,723	6,743	14.56%	14.56%	14.61%	0.53%	0.53%	0.53%	3.83%	3.83%	3.82%
	No changes	652	652	632	14.36%	14.36%	13.94%	0.18%	0.18%	0.18%	4.62%	4.62%	4.71%
Manganese	Decreases	10,777	10,803	10,868	15.49%	15.51%	15.45%	0.41%	0.41%	0.41%	3.68%	3.68%	3.67%
	No changes	262	236	171	13.98%	13.19%	16.04%	0.13%	0.13%	0.16%	2.07%	2.09%	2.22%
Mercury	Decreases	10,777	10,803	10,868	15.49%	15.51%	15.45%	0.41%	0.41%	0.41%	3.68%	3.68%	3.67%
	No changes	262	236	171	13.98%	13.19%	16.04%	0.13%	0.13%	0.16%	2.07%	2.09%	2.22%
Thallium	Decreases	10,777	10,803	10,868	15.49%	15.51%	15.45%	0.41%	0.41%	0.41%	3.68%	3.68%	3.67%
	No changes	262	236	171	13.98%	13.19%	16.04%	0.13%	0.13%	0.16%	2.07%	2.09%	2.22%
United States							**12.10%**			**0.60%**			**5.60%**

Source: U.S. EPA Analysis, 2024.

Notes:

a. Not all of the steam electric plants are estimated to discharge cyanide and lead. The associated socioeconomic characteristic information is only for the set of reaches with non-zero loadings for those pollutants (4,107 and 6,743 reaches for cyanide and lead, respectively, compared to 10,868 reaches for other pollutants).

b. Under the regulatory options, the largest change in the concentration of the pollutants analyzed is a decrease in manganese of 0.361 mg/L. Given the small range of pollutant changes observed (zero mg/L to -0.361 mg/L), EPA generalized these changes as "decreases" for each pollutant for ease of presentation.

Table 8. Percent of the Population Living Within 50 Miles of an Affected Downstream Reach with Modeled Concentrations of Selected Pollutants Under the Regulatory Options Identifying as a Racial or Ethnic Minority Compared to the National Average (Period 2)

Pollutant	Changes in Concentrations	Number of Downstream Reaches[a]			Percent Native Hawaiian/ Pacific Islander			Percent Other (Non-Hispanic)			Percent Hispanic/Latino		
		Option A	Option B	Option C	Option A	Option B	Option C	Option A	Option B	Option C	Option A	Option B	Option C
Antimony	Decreases[b]	10,777	10,803	10,868	0.07%	0.07%	0.07%	3.27%	3.27%	3.27%	11.61%	11.60%	11.55%
	No changes	91	65	0	0.03%	0.02%	0.00%	2.82%	2.82%	0.00%	2.20%	1.76%	0.00%
Arsenic	Decreases	10,777	10,803	10,868	0.07%	0.07%	0.07%	3.27%	3.27%	3.27%	11.67%	11.66%	11.61%
	No changes	262	236	171	0.06%	0.05%	0.07%	3.59%	3.62%	3.92%	5.21%	5.22%	6.53%
Cadmium	Decreases	10,777	10,803	10,868	0.07%	0.07%	0.07%	3.27%	3.27%	3.27%	11.67%	11.66%	11.61%
	No changes	262	236	171	0.06%	0.05%	0.07%	3.59%	3.62%	3.92%	5.21%	5.22%	6.53%
Cyanidea	Decreases	3,667	3,667	4,107	0.05%	0.05%	0.05%	3.11%	3.11%	3.11%	10.71%	10.71%	10.36%
	No changes	440	440	0	0.06%	0.06%	0.00%	3.09%	3.09%	0.00%	7.78%	7.78%	0.00%
Leada	Decreases	6,723	6,723	6,743	0.06%	0.06%	0.06%	3.42%	3.42%	3.42%	9.12%	9.12%	9.11%
	No changes	652	652	632	0.05%	0.05%	0.05%	3.01%	3.01%	3.01%	18.36%	18.36%	18.76%
Manganese	Decreases	10,777	10,803	10,868	0.07%	0.07%	0.07%	3.27%	3.27%	3.27%	11.67%	11.66%	11.61%
	No changes	262	236	171	0.06%	0.05%	0.07%	3.59%	3.62%	3.92%	5.21%	5.22%	6.53%
Mercury	Decreases	10,777	10,803	10,868	0.07%	0.07%	0.07%	3.27%	3.27%	3.27%	11.67%	11.66%	11.61%
	No changes	262	236	171	0.06%	0.05%	0.07%	3.59%	3.62%	3.92%	5.21%	5.22%	6.53%
Thallium	Decreases	10,777	10,803	10,868	0.07%	0.07%	0.07%	3.27%	3.27%	3.27%	11.67%	11.66%	11.61%
	No changes	262	236	171	0.06%	0.05%	0.07%	3.59%	3.62%	3.92%	5.21%	5.22%	6.53%
United States							**0.20%**			**3.50%**			**19.20%**

Source: U.S. EPA Analysis, 2024.

Notes:

a. Not all steam electric plants are estimated to discharge cyanide and lead. The associated socioeconomic characteristic information is only for the set of reaches with non-zero loadings for those pollutants (4,107 and 6,743 reaches for cyanide and lead, respectively, compared to 10,868 reaches for other pollutants).

b. Under the regulatory options, the largest change in the concentration of the pollutants analyzed is a decrease in manganese of 0.361 mg/L. Given the small range of pollutant changes observed (zero mg/L to -0.361 mg/L), EPA generalized these changes as “decreases” for each pollutant for ease of comprehension.

As shown in Table 7, communities living near the majority of reaches (regardless of the associated water quality change under the regulatory options) have a larger proportion of populations identified as African American (non-Hispanic) than the national average. As shown in Table 7 and Table 8, all of the reaches (regardless of the associated water quality change under the regulatory options) have a smaller proportion of people who identify as Asian (non-Hispanic), people who identify as American Indian or Alaska Native (non-Hispanic), people who identify as Native Hawaiian or Pacific Islander (non-Hispanic), and people who identify as Hispanic or Latino than national averages. In the majority of cases, reaches also have a smaller proportion of low-income population and population that identify as Other (non-Hispanic) than the national average. However, for certain pollutants, the reaches have larger than average proportions of the population for the previously mentioned demographics. For cyanide and lead, communities living near affected reaches (regardless of the associated water quality change under the regulatory options) have a larger proportion of low-income population than the national average. For arsenic, cadmium, manganese, mercury, and thallium, communities living near affected reaches (regardless of the associated water quality change under the regulatory options) have a larger proportion of population that identify as Other (non-Hispanic) than the national average.

3.4 Key Findings

The results of EPA's power plant proximity analysis indicate that, similar to the findings of the literature review, steam electric power plants are differentially located in low-income or minority communities. The analysis shows that communities located within one and three miles of a steam electric power plant have larger proportions of people identified as American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic]), and low-income than the average community when compared to the national average.

Additionally, the PWS and downstream proximity analyses indicate that, like the literature review suggests, population groups of concern may experience differential impacts from pollutants discharged by steam electric power plants. The PWS analysis shows that populations served by potentially affected PWSs have larger proportions of people identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), and Other (non-Hispanic) than the average community in the United States. Focusing on PWSs serving tribal areas, PWSs were found to serve areas with larger proportions of people identified as low-income and racial and ethnic groups other than American Indian or Alaska Native (non-Hispanic) than the average community in the states where the Tribal lands are located, the average community United States overall, and the average community in the rural United States. Furthermore, the downstream analysis shows that the majority of downstream reaches of receiving waters of steam electric power plants have communities living within 50 miles with larger proportions of people identified as low-income, African American (non-Hispanic), and Other (non-Hispanic) than the average community in the United States.

4. Analysis of the Distribution of Pollutant Exposures

For the final rule, EPA evaluated the distribution of pollutant exposures and health effects among all communities potentially affected under the baseline and each of the regulatory options. EPA conducted this analysis for each of the relevant pathways of exposure to pollutants from steam electric power plants: air (only analyzes Option B), surface water, and drinking water.

The objectives of this analysis were to determine:

- Whether, through each exposure pathway, under the baseline, communities with identified potential EJ concerns experience differential, and potentially disproportionate, and adverse pollutant exposures and/or health effects compared to communities with no identified potential EJ concerns.
- Whether differential, and potentially disproportionate, and adverse pollutant exposures and health effects experienced by communities with potential EJ concerns are expected to be mitigated, exacerbated, or created by each of the regulatory options.

The results of these analyses are presented and discussed in this section.

4.1 Baseline and Regulatory Options

This analysis evaluates three regulatory options, labelled A through C in increasing order of stringency, as shown in Table 9. With this action, EPA is finalizing limits based on Option B.

All three options include the same technology basis for FGD wastewater (zero discharge systems) and BA transport water (dry handling and closed-loop systems), while incrementally increasing controls on CRL and legacy wastewater and removing certain subcategories as one moves from Option A to Option C.

In estimating changes under each option, EPA compares projected pollutant discharges to those which would occur under the baseline, which reflects applicable requirements (in absence of the rule) of the 2020 rule (85 FR 64650).

4.1.1 FGD Wastewater

Under all three main options, EPA would require zero discharge of FGD wastewater based on zero-discharge technologies and retain the 2020 FGD wastewater limitations and standards as an interim step toward achievement of zero discharge requirements.

Under all three options, EPA would also eliminate the BAT and PSES subcategorizations for high FGD flow facilities and low-utilization electric generating units (LUEGUs). Option A and Option B would also create a subcategory for EGUs that will permanently cease coal combustion no later than December 31, 2034, and instead of zero discharge would require discharges from these facilities to meet the 2020 rule limitations as included in their CWA permit. This subcategory modifies the proposed early adopters subcategory. Under Option C, EPA would not finalize a subcategory for those planning to cease coal combustion by December 31, 2034. Note that, for all three options, EPA would retain the subcategory for electric generating units (EGUs) permanently ceasing coal combustion by 2028.

4.1.2 BA Transport Water

Under all three main options, EPA would require zero discharge of BA transport water based on dry-handling or closed-loop systems and retain the 2020 BA transport water limitations and standards as an interim step toward achievement of zero discharge requirements.

For all three options, EPA would also eliminate the BAT and PSES subcategorizations for LUEGUs. Option A and Option B would also create a subcategory for EGUs that will permanently cease coal combustion no later than December 31, 2034, and instead would require discharges from these facilities to meet the

2020 rule limitations as permitted. Under Option C, EPA would not finalize this subcategory. Note that, for all three options, EPA would retain the subcategory for EGUs permanently ceasing coal combustion by 2028.

4.1.3 CRL

Under Option A, EPA would establish BAT limitations and PSES for mercury and arsenic based on chemical precipitation treatment. Under Option B and Option C, BAT limitations and PSES would be zero discharge and EPA would establish BAT limitations and PSES for mercury and arsenic based on chemical precipitation for discharges of CRL through groundwater deemed by the permitting authority, on a case-by-case basis, to be functionally equivalent direct discharges. Option A and Option B would also create a subcategory for EGUs that would permanently cease coal combustion no later than December 31, 2034, and instead would leave these discharges subject to case-by-case BPJ decision-making until permanent cessation of coal combustion and then would subject the discharges to mercury and arsenic limitations based on chemical precipitation. Under Option C, EPA would not finalize this subcategory.

4.1.4 Legacy Wastewater

Under Option A, EPA would not specify a nationwide technology basis for BAT/PSES applicable to legacy wastewater at this time and such limitations would be derived on a site-specific basis by the permitting authorities, using their BPJ. Under Option B and Option C, EPA would establish a subcategory for discharges of legacy wastewater discharged from surface impoundments commencing closure after 60 days following the rule publication. For such discharges, EPA would establish mercury and arsenic limitations based on chemical precipitation.

Table 9. Regulatory Options Analyzed for the Final Rule

Wastestream	Subcategory	Technology Basis for BAT/PSES Regulatory Options[a]			
		2020 Rule (Baseline)	Option A	Option B (Final Rule)	Option C
FGD Wastewater	N/A	CP + Bio	ZLD	ZLD	ZLD
	EGUs permanently ceasing the combustion of coal by 2028	SI	SI	SI	SI
	EGUs permanently ceasing the combustion of coal by 2034	NS	2020 rule limitations as permitted	2020 rule limitations as permitted	NS
	High FGD Flow Facilities or LUEGUs	CP	NS	NS	NS
BA Transport Water	N/A	HRR	Dry-handling or closed-loop systems	Dry-handling or closed-loop systems	Dry-handling or closed-loop systems
	EGUs permanently ceasing the combustion of coal by 2028	SI	SI	SI	SI
	EGUs permanently ceasing the combustion of coal by 2034	NS	2020 rule limitations as permitted	2020 rule limitations as permitted	NS
	LUEGUs	BMP Plan	NS	NS	NS
CRL	N/A	BPJ	CP	ZLD	ZLD
	Discharges of unmanaged CRL	N/A	NS	CP	CP
	EGUs permanently ceasing the combustion of coal by 2034	N/A	Reserving for best professional judgement;	Reserving for best professional judgement;	NS

Table 9. Regulatory Options Analyzed for the Final Rule

Wastestream	Subcategory	Technology Basis for BAT/PSES Regulatory Options[a]			
		2020 Rule (Baseline)	Option A	Option B (Final Rule)	Option C
			CP after closure	CP after closure	
Legacy Wastewater	N/A	N/A	Reserving for best professional judgement	Reserving for best professional judgement	Reserving for best professional judgement
	Legacy wastewater discharged from surface impoundments commencing closure after [X date]	N/A	NS	CP	CP

Abbreviations: BMP = Best Management Practice; CP = Chemical Precipitation; HRR = High Recycle Rate Systems; SI = Surface Impoundment; ZLD = Zero Liquid Discharge; NS = Not subcategorized (default technology basis applies); NA = Not applicable

Notes

a. See Technical Development Document (TDD) for a description of these technologies (U.S. EPA, 2024e).

Source: U.S. EPA Analysis, 2024

The analyses described in the following sections focus on loadings associated with three main wastestreams: FGD wastewater, BA transport water, and CRL.

Legacy wastewater discharges and loading reductions achieved by the legacy wastewater limits in the final rule would occur only as plants close and dewater their existing ponds. Given the uncertainty on when plants may do so, EPA estimated no loading reductions during the period of analysis when modeling pollutant loadings and resulting exposure and health effects. Similarly, certain plants could be required to treat CRL discharged from landfills, surface impoundments, or other features via groundwater to meet the limits in the final rule. These limits would apply only in cases where a permitting authority deems, on a case-by-case basis, that the discharge is functionally equivalent to a direct discharge and requires a permit. Because these discharges are uncertain, EPA did not include CRL loads discharged to surface waters via groundwater when modeling pollutant loadings and resulting exposure and health effects.

4.2 Analysis of Exposures to Air Pollutants from Steam Electric Power Plants

EPA analyzed air pollutant exposures[22] across all communities potentially affected by the final rule to evaluate whether communities with EJ concerns experience differential, and potentially disproportionate, and adverse exposures, compared to relevant comparison population groups, under the baseline and the final rule. The analysis focuses on $PM_{2.5}$ and ozone exposures[23] from emissions from the steam electric power plants regulated under the final rule. EPA's approach to this analysis considered the provisions of the final rule, as well as the nature of known and potential exposures and impacts. As the final rule regulates steam electric power plants across the U.S., which typically have tall stacks and thus disperse emissions over large distances, it was appropriate to conduct a national-scale distributional analysis of $PM_{2.5}$ and ozone exposures. Using modeled baseline and policy $PM_{2.5}$ and ozone air quality surfaces, EPA

[22] The term "exposure" is used here to describe estimated $PM_{2.5}$ and ozone concentrations, not individual dosage.

[23] Air quality surfaces used to estimate exposures are based on 12-kilometer x 12-kilometer grids. More information on air quality modeling can be found in Chapter 8 of the BCA (U.S. Environmental Protection Agency. (2024a). *Benefit and Cost Analysis for Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*. (821-R-24-006).).

analyzed changes in $PM_{2.5}$ and ozone concentrations resulting from the emission changes projected by the Integrated Planning Model (IPM)[24] to occur under the final rule as compared to the baseline, characterizing average and distributional exposures both prior to and following implementation in 2030. Population characteristics considered in the distributional analysis were race, ethnicity, educational attainment, poverty status, linguistic isolation, age, and sex (Table 10).[25]

Table 10. Population Characteristics Included in the Ozone and $PM_{2.5}$ Distributional Analyses

Demographic Characteristics	Description
Race	Asian; American Indian; Black; White
Ethnicity	Hispanic; Non-Hispanic
Educational Attainment	Over age 24 with/without a high school diploma
Poverty Status	Above /below 200% of the poverty line; Above/below the poverty line
Linguistic Isolation	Speaks/does not speak English “very well or better”; Speaks/does not speak English less than “well or better”
Age	Children (0-17); Adults (18-64); Older Adults (65-99)
Sex	Female; Male

Important caveats of this analysis include:

- $PM_{2.5}$ and ozone concentration changes associated with the final rule are relatively small in magnitude. As a result, the potential for the final rule to mitigate or exacerbate existing disparities among demographic groups is small.
- Although several future years were assessed for health benefits associated with this final rulemaking, there was variability in high year-to-year $PM_{2.5}$ and ozone concentration change across modeled future years. Only 2030 is analyzed for air pollutant distributional implications because 2030 is the

[24] As discussed in greater detail in U.S. Environmental Protection Agency. (2018). *Documentation for EPA's Power Sector Modeling Platform v6 Using the Integrated Planning Model*. 1200 Pennsylvania Avenue, NW, Washington D.C. 20460, IPM is a comprehensive electricity market optimization model that can evaluate the impacts of regulatory actions affecting the power sector within the context of regional constraints such as environmental, demand, and other operational constraints. It uses a long-term dynamic linear programming framework that simulates the dispatch of generating capacity to achieve a demand-supply equilibrium on a seasonal basis and by region. The model computes optimal capacity that combines short-term dispatch decisions with long-term investment decisions. IPM runs under the assumption that electricity demand must be met and maintains a consistent expectation of future load. IPM outputs include the air emissions resulting from the simulated generation mix. Refer to the Regulatory Impact Analysis (RIA) report for more details on the IPM model runs (U.S. Environmental Protection Agency. (2024c). *Regulatory Impact Analysis for Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*. (821-R-24-007).).

[25] Population projections stratified by race/ethnicity, age, and sex are based on economic forecasting models developed by Woods & Poole. (2015). *Complete Demographic Database*. https://www.woodsandpoole.com/ . The Woods and Poole database contains county-level projections of population by age, sex, and race out to 2050, relative to a baseline using the 2010 Census data. Population projections for all U.S. counties are determined simultaneously to consider patterns of economic growth and migration. County-level estimates of population percentages within the poverty status and educational attainment groups were derived from 2015 to 2019 five-year average ACS estimates. More information can be found in Appendix J of the BenMAP-CE user’s manual (https://www.epa.gov/benmap/benmap-ce-manual-and-appendices).

nearest future year in which all affected steam electric power plants are expected to be in compliance with the final rule.[26]

4.2.1 Analysis of Changes in Air Quality Across Affected Areas of the Contiguous U.S.

As IPM predicts, the final rule will lead to both decreases and increases in emissions in 2030. Given this, to characterize changes in emissions of $PM_{2.5}$ and ozone across the contiguous United States, EPA grouped affected areas into those where air quality does not change, improves, or worsens as a result of the final rule. As air quality changes associated with the final rule were estimated to be small, EPA used a cutoff of changes in concentrations that were at least a ten-thousandth of each pollutant's 2023 National Ambient Air Quality Standard (NAAQS) (+/- 0.007 ppb of ozone and 0.0012 $\mu g/m^3$ of $PM_{2.5}$) to define "changing" air quality.

In 2030, 365 million people are predicted to live in the contiguous United States. Applying the groupings and definition of changing air quality, the results of the IPM analysis show that, under the final rule, approximately 60 percent and 50 percent of the U.S. population, respectively, resides in areas predicted to experience changes in ozone and $PM_{2.5}$ concentrations compared to the baseline (Figure 1). In the areas where air quality changes are predicted under the final rule, 91 percent (202.5 million) and 83 percent (140.8 million) of the population, respectively, is predicted to experience air quality improvements for ozone and $PM_{2.5}$ compared to the baseline (Figure 1). Additionally, in the areas where air quality changes are predicted under the final rule, 9 percent (20.5 million) and 16 percent (27.3 million) of the population, respectively, is predicted to experience worsening air quality for ozone and $PM_{2.5}$ compared to the baseline (Figure 1). EPA notes that ozone and $PM_{2.5}$ changes under the final rule in areas experiencing worsening air quality are predicted to be small compared to the baseline, averaging approximately 0.06 ppb for ozone and 0.00 $\mu g/m^3$ for $PM_{2.5}$. Additionally, while increases in $PM_{2.5}$ concentrations under the final rule are predicted for a nontrivial number of people in 2030, EPA notes that increases in $PM_{2.5}$ concentrations in later modeled future year scenarios not included in this analysis (2035, 2040, 2045, and 2050) occur in substantially fewer areas.

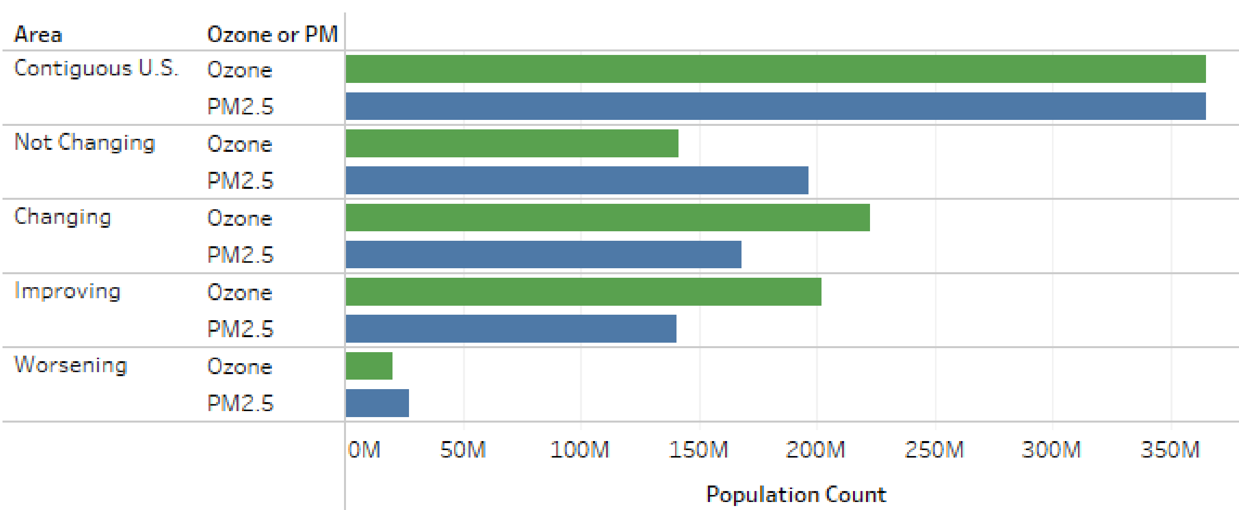

Figure 1. Number of People in the Contiguous U.S. Residing in Areas with Not Changing, Changing, Improving, and Worsening Modeled Ozone and $PM_{2.5}$ Concentrations in 2030

26 This differs from the analyses performed in the RIA which use 2035 as the compliance year.

4.2.2 Distribution of Ozone Exposures in Communities with Predicted Changes in Air Quality

For areas with predicted changes in ozone concentrations under the final rule, EPA conducted a distributional analysis to determine whether population groups of concern experience differential, and potentially disproportionate, and adverse exposures to ozone relative to their relevant comparison population groups under the baseline and whether such differential exposures among population groups of concern are mitigated, exacerbated, or created under the final rule.

As described in Chapter 8 of the BCA, higher ozone exposure is associated with a wide range of adverse health effects, including premature mortality; respiratory effects, including increases in hospital admissions and emergency room visits, asthma onset and symptom exacerbation, allergic rhinitis (hay fever) symptoms; cardiovascular and nervous system effects; and reproductive and developmental effects (U.S. EPA, 2024a). Thus, reducing exposure to ozone can provide both health and economic benefits, whose significance may depend on socioeconomic factors (*e.g.*, susceptibility or vulnerability according to income or race/ethnicity, access to healthcare).

Figure 2 is a map of the areas with predicted changes in ozone concentrations under the final rule in 2030. The map shows areas in which the warm season (April – September) MDA8 ozone concentrations improve (shown in blue) or worsen (shown in red) – by at least +/- 0.007 ppb - under the final rule.

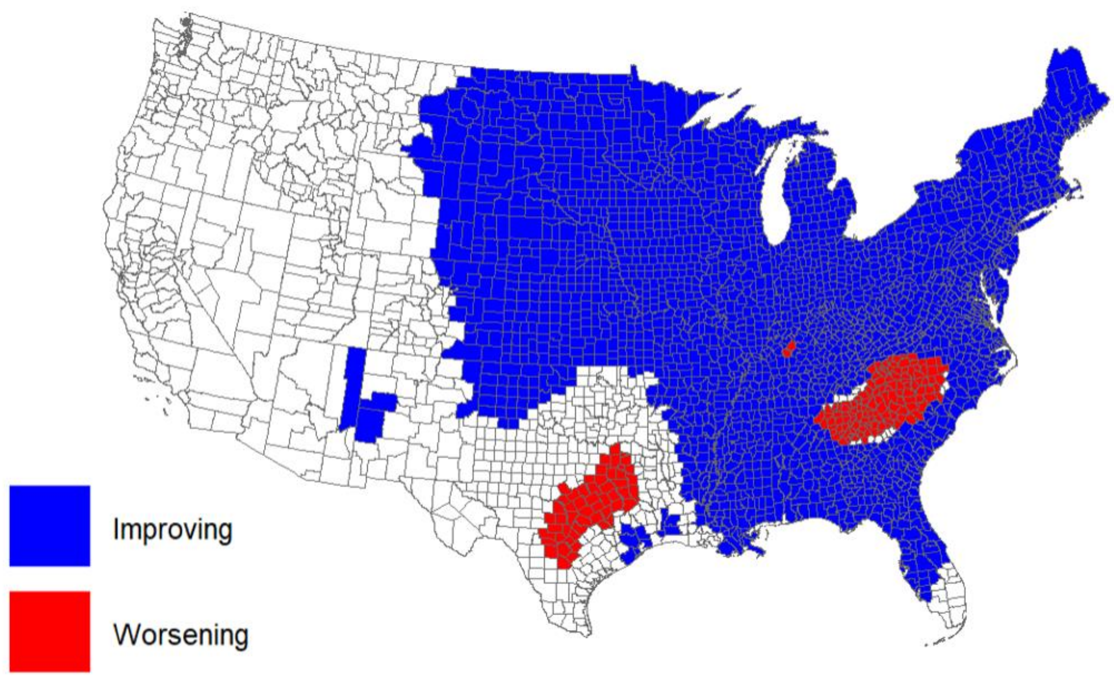

Figure 2. Map of 12-km Grid Cells with Modeled Changes in MDA8 Warm Season Ozone Concentrations Improving or Worsening by at Least +/-0.007 ppb in 2030

In areas shown as having predicted improvements in air quality in 2030, decreases in ozone are driven by the net reduction in regional NO_x emissions from the steam electric power generating sector as a result of the final rule. In areas shown as having predicted worsening air quality in 2030, increases in ozone are the result of a relatively small number of sources with predicted increases in NO_x emissions under the final rule due to IPM-projected changes in the future dispatch of certain electricity generation units after promulgation of the final rule.

Comparing the baseline concentrations of MDA8 ozone in areas with predicted changing ozone concentrations under the final rule to the baseline concentrations of MDA8 ozone in areas with no predicted change in ozone concentrations, EPA found that areas not affected by ozone changes from the final rule have, on average, higher baseline MDA8 ozone concentrations (Figure 3). Additionally, the areas expected to experience worsening ozone concentrations under the final rule have lower baseline average ozone concentrations than any other group (Figure 3). As the population in areas with changing ozone concentrations under the final rule is nearly identical to the population in areas with improving ozone concentrations under the final rule, the two dots are next to one another in Figure 3.

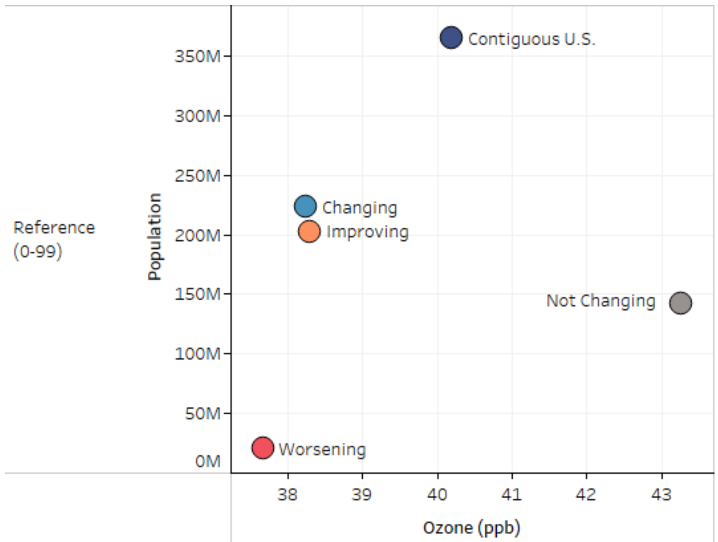

Figure 3. Baseline MDA8 Ozone Concentrations and Population Counts in Areas with Not Changing, Changing, Improving, and Worsening Modeled Ozone Concentrations in 2030.

To determine whether disparities in exposure were present under the baseline and whether they were mitigated, exacerbated, or created by the final rule, EPA modeled average baseline warm season MDA8 ozone concentrations and MDA8 ozone concentration changes under the final rule across population groups of concern compared to the overall reference group (labeled "Reference [0-99]") and their relevant comparison groups (*e.g.*, White [non-Hispanic] for racial or ethnic groups). Different areas, air quality scenarios, and methods of showing results are presented across the columns in Table 11[27]. More information on the columns in Table 11 can be found in Table 12.

[27] Numbers in Table 11 extend two and three places beyond the decimal point due to the small magnitude of air quality changes; this is not intended to convey confidence in EPA's ability to estimate air quality exposures to that level of exactness.

Table 11. Modeled MDA8 Ozone Concentrations (ppb) Across Area Categories and Selected Population Groups in 2030

Population Groups	Population (Ages)	1. Contiguous U.S. Baseline	2. Contiguous U.S. Policy	3. Changes in Contiguous U.S.	4. % Change in Contiguous U.S.	5. Baseline Areas Changing	6. Policy Areas Changing	7. Changes in Policy Areas Changing	8. % Changes in Changing Areas	9. Baseline Areas Improving	10. Policy Areas Improving	11. Changes in Improving Areas	12. % Changes in Improving Areas	13. Baseline Areas Worsening	14. Policy Areas Worsening	15. Changes in Worsening Areas	16. % Changes in Worsening Areas	17. Areas Not Changing
Reference	Reference (0-99)	40.20	40.18	0.02	0.04	38.24	38.22	0.02	0.06	38.30	38.27	0.03	0.08	37.67	37.72	-0.06	-0.15	43.27
Race	White (0-99)	40.29	40.28	0.02	0.04	38.19	38.17	0.02	0.06	38.25	38.22	0.03	0.09	37.54	37.59	-0.06	-0.16	43.52
	American Indian (0-99)	42.55	42.54	0.01	0.02	38.20	38.18	0.02	0.05	38.24	38.21	0.03	0.07	37.74	37.79	-0.05	-0.13	44.99
	Asian (0-99)	41.53	41.51	0.01	0.03	39.22	39.19	0.03	0.07	39.31	39.27	0.03	0.09	38.14	38.19	-0.06	-0.15	43.78
	Black (0-99)	38.80	38.79	0.02	0.04	38.14	38.12	0.02	0.05	38.16	38.13	0.03	0.08	38.00	38.06	-0.05	-0.14	40.52
Ethnicity	Non-Hispanic (0-99)	39.57	39.55	0.02	0.04	38.13	38.10	0.02	0.07	38.17	38.14	0.03	0.09	37.64	37.70	-0.06	-0.16	42.59
	Hispanic (0-99)	42.41	42.40	0.01	0.02	38.96	38.94	0.02	0.05	39.16	39.13	0.03	0.08	37.78	37.82	-0.04	-0.12	44.52
Educational Attainment	More educated (>24; HS or more)	40.01	40.00	0.02	0.04	38.23	38.20	0.02	0.06	38.28	38.25	0.03	0.09	37.66	37.72	-0.06	-0.15	43.03
	Less educated (>24; no HS)	40.70	40.69	0.01	0.03	38.17	38.15	0.02	0.06	38.25	38.22	0.03	0.08	37.56	37.61	-0.06	-0.15	43.69
Poverty Status	>200% of the poverty line (0-99)	40.19	40.18	0.02	0.04	38.33	38.31	0.02	0.06	38.39	38.36	0.03	0.09	37.67	37.73	-0.06	-0.15	43.24
	<200% of the poverty line (0-99)	40.20	40.18	0.01	0.03	38.05	38.03	0.02	0.06	38.09	38.06	0.03	0.08	37.65	37.71	-0.06	-0.15	43.30
	>Poverty line (0-99)	40.19	40.18	0.02	0.04	38.27	38.25	0.02	0.06	38.33	38.30	0.03	0.09	37.67	37.72	-0.06	-0.15	43.24
	<Poverty line (0-99)	40.21	40.19	0.01	0.04	38.08	38.06	0.02	0.06	38.12	38.09	0.03	0.08	37.67	37.72	-0.06	-0.15	43.36
Linguistic Isolation	English “very well or better” (0-99)	40.05	40.03	0.02	0.04	38.18	38.16	0.02	0.06	38.24	38.20	0.03	0.08	37.65	37.71	-0.06	-0.15	43.21
	English < “very well” (0-99)	41.73	41.72	0.01	0.02	39.13	39.11	0.02	0.06	39.28	39.25	0.03	0.08	37.89	37.93	-0.05	-0.13	43.65
	English “well or better” (0-99)	40.12	40.10	0.02	0.04	38.21	38.19	0.02	0.06	38.27	38.24	0.03	0.08	37.66	37.72	-0.06	-0.15	43.24
	English < “well” (0-99)	41.80	41.79	0.01	0.02	39.15	39.13	0.02	0.06	39.31	39.28	0.03	0.08	37.87	37.92	-0.05	-0.13	43.59
Age	Children (0-17)	40.41	40.40	0.01	0.04	38.31	38.28	0.02	0.06	38.37	38.34	0.03	0.08	37.70	37.75	-0.06	-0.15	43.59
	Adults (18-64)	40.25	40.24	0.01	0.04	38.29	38.26	0.02	0.06	38.35	38.32	0.03	0.08	37.71	37.76	-0.06	-0.15	43.29
	Older Adults (65-99)	39.80	39.78	0.02	0.04	38.04	38.02	0.03	0.07	38.09	38.06	0.03	0.09	37.50	37.56	-0.06	-0.15	42.81
Sex	Females (0-99)	40.18	40.17	0.02	0.04	38.26	38.23	0.02	0.06	38.32	38.28	0.03	0.08	37.67	37.73	-0.06	-0.15	43.25
	Males (0-99)	40.21	40.19	0.02	0.04	38.23	38.20	0.02	0.06	38.28	38.25	0.03	0.08	37.66	37.72	-0.06	-0.15	43.28

[a] Note: All concentrations, changes, and percentage changes have been rounded to 2 decimal places to better reflect the precision limitations of the air quality data input.

Table 12. Additional Information on the Column Headers Used in Table 11 and Table 13

Area Category	Description
1. Contiguous U.S. Baseline	Average exposure burden under the baseline scenario averaged across the population in the entire contiguous U.S.
2. Contiguous U.S. Policy	Average exposure burden under the policy scenario averaged across the population in the entire contiguous U.S.
3. Changes in Contiguous U.S.	Average exposure changes when moving from the baseline to the policy scenario averaged across the population in the entire contiguous U.S.
4. % Change in Contiguous U.S.	Average exposure changes as a percent of baseline exposure when moving from the baseline to the policy scenario averaged across the population in the entire contiguous U.S.
5. Baseline Areas Changing	Average exposure burden under the baseline scenario averaged across the population experiencing a change of at least 1/10,000th of the 2023 NAAQS
6. Policy Areas Changing	Average exposure burden under the policy scenario averaged across the population experiencing a change of at least 1/10,000th of the 2023 NAAQS
7. Changes in Policy Areas Changing	Average exposure changes when moving from the baseline to the policy scenario averaged across the population experiencing an air quality change of at least 1/10,000th of the 2023 NAAQS
8. % Changes in Changing Areas	Average exposure changes as a percent of baseline exposure when moving from the baseline to the policy scenario averaged across the population experiencing an air quality change of at least 1/10,000th of the 2023 NAAQS
9. Baseline Areas Improving	Average exposure burden under the baseline scenario averaged across the population experiencing an air quality improvement of at least 1/10,000th of the 2023 NAAQS
10. Policy Areas Improving	Average exposure burden under the policy scenario averaged across the population experiencing an air quality improvement of at least 1/10,000th of the 2023 NAAQS
11. Changes in Improving Areas	Average exposure changes when moving from the baseline to the policy scenario averaged across the population experiencing an air quality improvement of at least 1/10,000th of the 2023 NAAQS
12. % Changes in Improving Areas	Average exposure changes as a percent of baseline exposure when moving from the baseline to the policy scenario averaged across the population experiencing an air quality improvement of at least 1/10,000th of the 2023 NAAQS
13. Baseline Areas Worsening	Average exposure burden under the baseline scenario averaged across the population experiencing an air quality worsening of at least 1/10,000th of the 2023 NAAQS
14. Policy Areas Worsening	Average exposure burden under the policy scenario averaged across the population experiencing an air quality worsening of at least 1/10,000th of the 2023 NAAQS
15. Changes in Worsening Areas	Average exposure changes when moving from the baseline to the policy scenario averaged across the population experiencing an air quality worsening of at least 1/10,000th of the 2023 NAAQS
16. % Changes in Worsening Areas	Average exposure changes as a percent of baseline exposure when moving from the baseline to the policy scenario averaged across the population experiencing an air quality worsening of at least 1/10,000th of the 2023 NAAQS
17. Areas Not Changing	Average exposure burden under the areas not changing or changing by less than 1/10,000th of the 2023 NAAQS

Based on the results of the analysis, EPA determined that the final rule leads to small changes in MDA8 ozone concentrations. Across the contiguous United States, the average total warm-season MDA8 ozone concentrations under the baseline and final rule (shown in columns 1 and 2 in Table 11) are similar when averaged across the lower 48 states. The absolute magnitude of these changes is less than 0.06 ppb, or about a 0.1-0.2 percent change from baseline concentrations, as shown in the first and second grayshaded columns in Table 11. Columns 5-8 in the table show MDA8 concentrations in changing areas, which includes both areas in which MDA8 ozone concentrations improve (shown in columns 9-12) and areas in which they worsen (shown in columns 13-16).[28] Column 17 shows MDA8 ozone concentrations by population group in the areas that are not affected by the final rule.

Given that baseline MDA8 ozone concentrations for the final rule are similar to those for other recent rulemakings (*e.g.*, the regulatory impact analysis [RIA] for the proposed federal implementation plan on ozone transport for the 2015 ozone NAAQS (U.S. EPA, 2022) and areas changing can be more meaningfully discussed by directly addressing improving and worsening areas, columns 1-8 in Table 11 are not discussed in detail here.[29]

Although there are differences in baseline exposures across population groups and area categories, the absolute and relative changes across population groups of concern in improving and worsening areas under the final rule are similar (shown in columns 11-12 and 15-16 in Table 11). This suggests that MDA8 ozone exposure disparities are not created, exacerbated, or mitigated under the final rule as compared to the baseline.

To further evaluate distributional impacts, EPA evaluated differences in MDA8 ozone exposures across the various population groups of concern compared to their relevant comparison groups. Figure 4 shows the results. For total exposures (columns 1, 2, 4, 5, 7, 8, 10, 11, and 13 in the figure), colored lines to the right and left of the black line indicate differentially high and low exposures in the population group of concern relative to the comparison group. For exposure changes (columns 3, 6, 9, and 12), colored lines to the right and left of the black line indicate differentially large and small exposure reductions in the population group of concern relative to the comparison group.

[28] In other EJ and benefits assessments, air quality improvements have been shown as positive numbers. In keeping with this precedent, worsening air quality concentrations are presented as negative numbers here.

[29] For a discussion, see the Regulatory Impacts Analysis for the Proposed Federal Implementation Plan Addressing Regional Ozone Transport for the 2015 Ozone NAAQS (U.S. Environmental Protection Agency. (2022). *Regulatory Impact Analysis for Proposed Federal Implementation Plan Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standard*. (EPA-452/D-22-001). Retrieved from https://www.epa.gov/system/files/documents/2022-03/transport_ria_proposal_fip_2015_ozone_naaqs_2022-02.pdf)

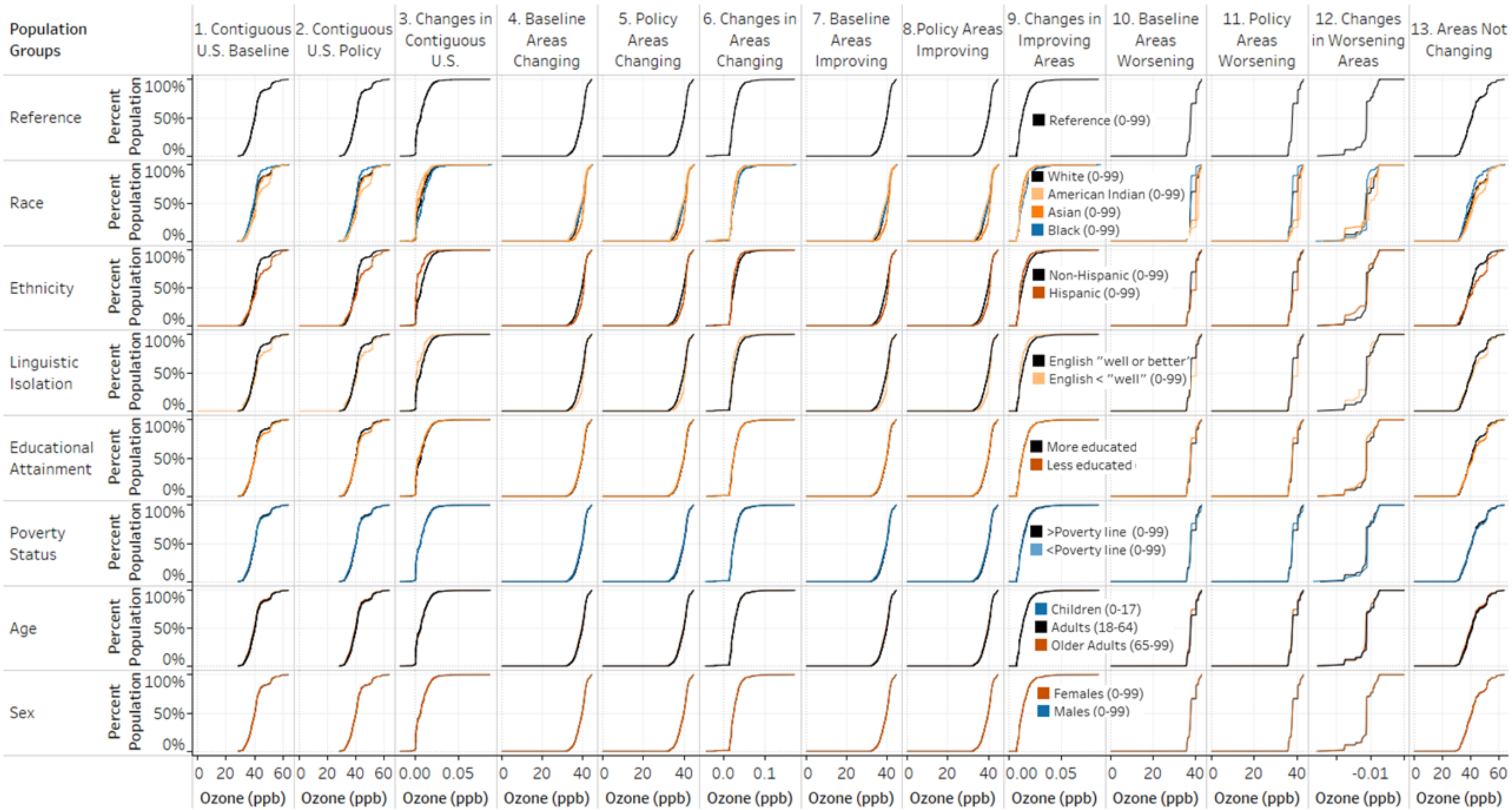

Figure 4. Distribution of Modeled MDA8 Ozone Concentrations Across Area Categories and Selected Population Groups in 2030

4.2.3 Distribution of $PM_{2.5}$ Exposures in Communities with Predicted Changes in Air Quality

In areas with predicted changes in $PM_{2.5}$ concentrations under the final rule, EPA conducted a distributional analysis to determine whether population groups of concern experience differential, and potentially disproportionate, and adverse exposures to annual average $PM_{2.5}$ concentrations as compared to their relevant comparison groups under the baseline and whether such differential exposures among communities with EJ concerns are mitigated, exacerbated, or created under the final rule.

As described in Chapter 8 of the BCA, higher $PM_{2.5}$ exposure is associated with a wide range of adverse health effects, including:

- Premature mortality.
- Cardiovascular effects such as heart attacks, strokes, and increased hospital admissions or emergency department visits due to cardiovascular problems.
- Respiratory effects, including hospital admissions or emergency department visits, and onset or exacerbation of asthma symptoms, lung cancer, and allergic rhinitis (hay fever) symptoms.
- Alzheimer's disease.
- Parkinson's disease.
- Other nervous system effects (*e.g.*, autism, cognitive decline, dementia).
- Metabolic effects (*e.g.*, diabetes).
- Reproductive and developmental effects (*e.g.*, low birth weight, pre-term births).
- Cancer, mutagenicity, and genotoxicity effects. (U.S. EPA, 2024a)

Thus, reducing exposure to PM2.5 provides both health and economic benefits on populations, with the significance of the benefits depending on socioeconomic factors (*e.g.*, susceptibility or vulnerability among subgroups according to income or race/ethnicity, access to healthcare). Figure 5 is a map of the areas with predicted changes in average annual $PM_{2.5}$ concentrations under the final rule in 2030. The map shows areas in which the average annual $PM_{2.5}$ concentrations improve (shown in blue) or worsen (shown in red)–by at least +/- 0.0012 $\mu g/m^3$ under the final rule.

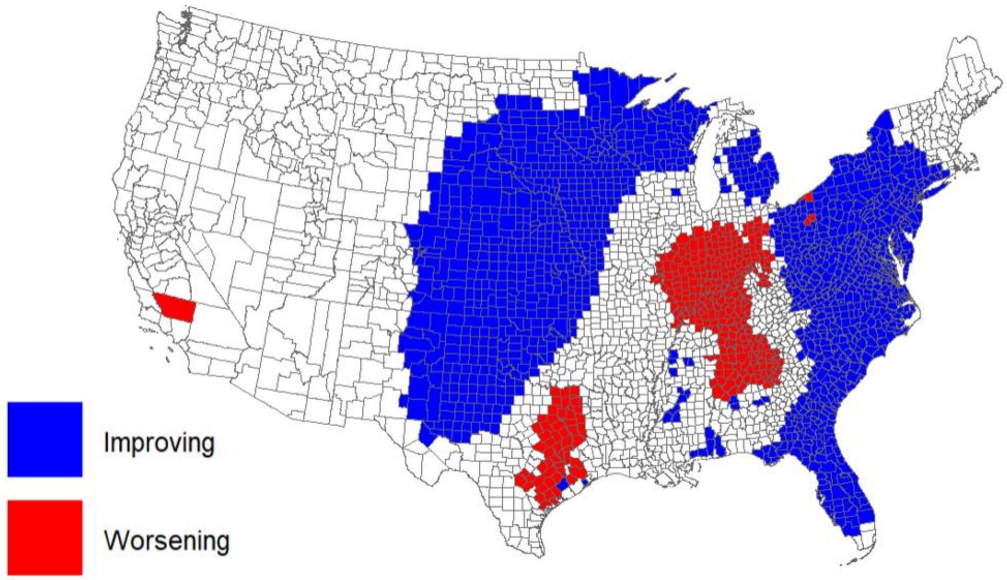

Figure 5. Map of 12-km Grid Cells with Modeled Changes in Average Annual PM2.5 Concentrations Improving or Worsening by at Least +/-0.0012 µg/m³ in 2030

EPA found that changes in $PM_{2.5}$ emissions are driven by changes in the types of steam EGUs that are being dispatched in any given future year. In certain out-years, higher-emitting units may be dispatched to meet generation needs, which could result in $PM_{2.5}$ emissions increases in those particular years. Figure 6 shows the average annual baseline $PM_{2.5}$ concentrations for the areas in the contiguous United States that are affected by the final rule.

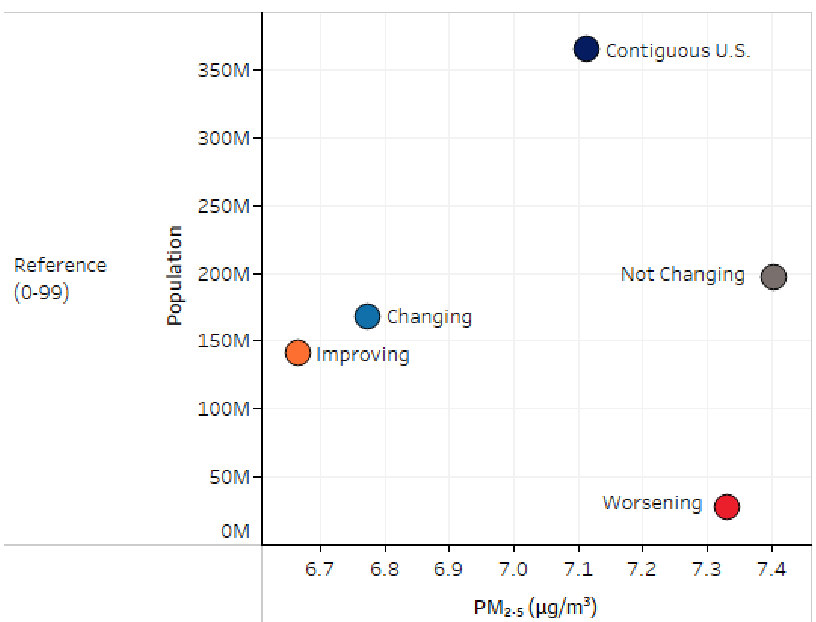

Figure 6. Baseline Average Annual PM2.5 Concentrations and Population Counts in Areas with Not Changing, Changing, Improving, and Worsening Modeled PM2.5 concentrations in 2030

Comparing baseline average annual $PM_{2.5}$ concentrations in areas with predicted change in $PM_{2.5}$ concentrations under the final rule to baseline average annual $PM_{2.5}$ concentrations in areas with no predicted change in $PM_{2.5}$ concentrations under the baseline, EPA found that, as with MDA8 ozone concentrations, the baseline average annual $PM_{2.5}$ concentrations in areas with no predicted change were higher than in areas with a predicted change. Unlike with MDA8 ozone concentrations, areas predicted to experience not changing or worsening $PM_{2.5}$ concentrations under the final rule had higher baseline average annual $PM_{2.5}$ concentrations than all other area categories analyzed. However, EPA notes that very few areas are predicted to have increased average annual $PM_{2.5}$ concentrations due to the final rule in modeled future years after 2030. Additionally, average annual $PM_{2.5}$ concentration increases in these areas are very small and round to 0.00 $\mu g/m^3$. To determine whether differential exposures among population groups of concern were present under the baseline and whether they were mitigated, exacerbated, or created by the final rule, EPA modeled baseline annual average $PM_{2.5}$ concentrations and concentration changes across various population groups of concern. Table 13 presents the results. It is organized in the same way as Table 11, with rows for population groups and columns for areas, air quality scenarios, and methods.[30]

[30] Numbers in Table 13 extend two and three places beyond the decimal point due to the small magnitude of air quality changes; this is not intended to convey confidence in EPA's ability to estimate air quality exposures to that level of exactness.

Table 13. Modeled Average Annual $PM_{2.5}$ Concentrations[a] ($\mu g/m^3$) Across Area Categories and Selected Population Groups in 2030[b]

Population Groups	Population (Ages)	1. Contiguous U.S. Baseline	2. Contiguous U.S. Policy	3. Changes in Contiguous U.S.	4. % Change in Contiguous U.S.	5. Baseline Areas Changing	6. Policy Areas Changing	7. Changes in Policy Areas	8. % Changes in Changing Areas	9. Baseline Areas Improving	10. Policy Areas Improving	11. Changes in Improving Areas	12. % Changes in Improving Areas	13. Baseline Areas Worsening	14. Policy Areas Worsening	15. Changes in Worsening Areas	16. % Changes in Worsening Areas	17. Areas Not Changing
Reference	Reference (0-99)	7.11	7.11	0.00	0.01	6.77	6.77	0.00	0.03	6.67	6.66	0.00	0.04	7.33	7.33	0.00	-0.03	7.41
Race	White (0-99)	7.02	7.02	0.00	0.01	6.65	6.65	0.00	0.03	6.54	6.54	0.00	0.04	7.21	7.21	0.00	-0.03	7.33
	American Indian (0-99)	6.66	6.66	0.00	0.01	6.49	6.49	0.00	0.03	6.38	6.38	0.00	0.04	7.39	7.39	0.00	-0.03	6.74
	Asian (0-99)	7.69	7.69	0.00	0.01	7.15	7.15	0.00	0.03	7.05	7.05	0.00	0.04	7.82	7.82	0.00	-0.02	8.07
	Black (0-99)	7.35	7.35	0.00	0.02	7.19	7.19	0.00	0.03	7.08	7.08	0.00	0.04	7.73	7.73	0.00	-0.02	7.56
Ethnicity	Non-Hispanic (0-99)	6.89	6.89	0.00	0.01	6.73	6.73	0.00	0.03	6.63	6.62	0.00	0.04	7.28	7.29	0.00	-0.03	7.05
	Hispanic (0-99)	7.91	7.91	0.00	0.01	6.98	6.98	0.00	0.03	6.87	6.86	0.00	0.04	7.60	7.60	0.00	-0.02	8.36
Educational Attainment	More educated (>24; HS or more)	7.02	7.02	0.00	0.01	6.74	6.74	0.00	0.03	6.64	6.63	0.00	0.04	7.31	7.31	0.00	-0.03	7.26
	Less educated (>24; no HS)	7.45	7.45	0.00	0.01	6.86	6.86	0.00	0.03	6.76	6.75	0.00	0.04	7.35	7.35	0.00	-0.03	7.87
Poverty Status	>200% of the poverty line (0-99)	7.05	7.05	0.00	0.01	6.74	6.74	0.00	0.03	6.64	6.64	0.00	0.04	7.31	7.31	0.00	-0.03	7.32
	<200% of the poverty line (0-99)	7.25	7.25	0.00	0.01	6.84	6.84	0.00	0.03	6.73	6.73	0.00	0.04	7.38	7.38	0.00	-0.03	7.58
	>Poverty line (0-99)	7.08	7.08	0.00	0.01	6.75	6.75	0.00	0.03	6.64	6.64	0.00	0.04	7.32	7.32	0.00	-0.03	7.37
	<Poverty line (0-99)	7.29	7.29	0.00	0.01	6.89	6.89	0.00	0.03	6.79	6.78	0.00	0.04	7.41	7.41	0.00	-0.03	7.60
Linguistic Isolation	English "very well or better" (0-99)	7.03	7.03	0.00	0.01	6.75	6.74	0.00	0.03	6.64	6.63	0.00	0.04	7.30	7.31	0.00	-0.03	7.29
	English < "very well" (0-99)	7.95	7.95	0.00	0.01	7.16	7.16	0.00	0.03	7.05	7.05	0.00	0.04	7.71	7.72	0.00	-0.02	8.41
	English "well or better" (0-99)	7.07	7.07	0.00	0.01	6.76	6.76	0.00	0.03	6.65	6.65	0.00	0.04	7.32	7.32	0.00	-0.03	7.34
	English < "well" (0-99)	8.06	8.06	0.00	0.01	7.20	7.19	0.00	0.03	7.09	7.09	0.00	0.04	7.74	7.74	0.00	-0.02	8.55
Age	Children (0-17)	7.18	7.18	0.00	0.01	6.80	6.80	0.00	0.03	6.68	6.68	0.00	0.04	7.35	7.35	0.00	-0.03	7.49
	Adults (18-64)	7.16	7.16	0.00	0.01	6.82	6.81	0.00	0.03	6.71	6.71	0.00	0.04	7.36	7.36	0.00	-0.03	7.45
	Older Adults (65-99)	6.91	6.90	0.00	0.01	6.63	6.62	0.00	0.03	6.53	6.52	0.00	0.04	7.22	7.22	0.00	-0.03	7.15
Sex	Females (0-99)	7.12	7.12	0.00	0.01	6.79	6.78	0.00	0.03	6.68	6.68	0.00	0.04	7.34	7.34	0.00	-0.03	7.42
	Males (0-99)	7.10	7.10	0.00	0.01	6.76	6.76	0.00	0.03	6.65	6.65	0.00	0.04	7.33	7.33	0.00	-0.03	7.39

[a] Note: All concentrations, changes, and percentage changes have been rounded to 2 decimal places to better reflect the precision limitations of the air quality data input.

[b] Note: Additional information on the column headers can be found in Table 12.

Based on the results of the analysis, EPA determined that the final rule would lead to small average annual $PM_{2.5}$ concentration improvements. Average total annual $PM_{2.5}$ concentrations across the entire contiguous U.S. under the baseline and the final rule (columns 1 and 2 in Table 13) are similar when averaged across the lower 48 states. The absolute magnitude of these changes is very small and rounds to 0.00 $\mu g/m^3$, with estimated changes less than a 0.03 percent change from baseline concentrations, as shown in Table 13. Columns 5-8 in the table show average annual $PM_{2.5}$ concentrations in areas with predicted changes under the final rule, which includes both areas in which average annual $PM_{2.5}$ concentrations improve (columns 9-12) or worsen (columns 13-16).[31] Column 17 shows average annual $PM_{2.5}$ concentrations by population group in areas not affected by the final rule. Because average annual $PM_{2.5}$ concentrations in the baseline for the final rule are similar to those in other recent rulemakings (*e.g.*, the RIA for the Reconsideration of the NAAQS for PM) and areas changing can be more meaningfully discussed by directly considering improving and worsening areas, columns 1-8 in Table 13 are not discussed in detail here. As with MDA8 ozone concentrations, EPA found that there are differences in baseline average annual $PM_{2.5}$ exposures across population groups and area categories (Table 13). Also, as with MDA8 ozone, absolute and relative changes in average annual $PM_{2.5}$ exposures across population groups in improving and worsening areas are similar (columns 11-12 and 15-16 in Table 13). This suggests that average annual $PM_{2.5}$ exposure disparities are not created, exacerbated, or mitigated under the final rule compared to the baseline. To further evaluate distributional impacts, EPA evaluated differences in average annual $PM_{2.5}$ exposures between the various population groups of concern and their relevant comparison groups. Figure 7 presents the results. Colored lines to the right and left of the black line of total exposure distributions (columns 1, 2, 4, 5, 7, 8, 10, 11, and 13) indicate differentially high and low exposures in the population group of concern compared to the comparison group. Colored lines to the right and left of the black line of exposure changes (columns 3, 6, 9, and 12 in Figure 7) indicate differentially large and small exposure reductions in the population group of concerns compared to the comparison group.

[31] In other distributional and benefits assessments, air quality improvements have been shown as positive numbers. In keeping with this precedent, worsening air quality concentrations are presented as negative numbers here.

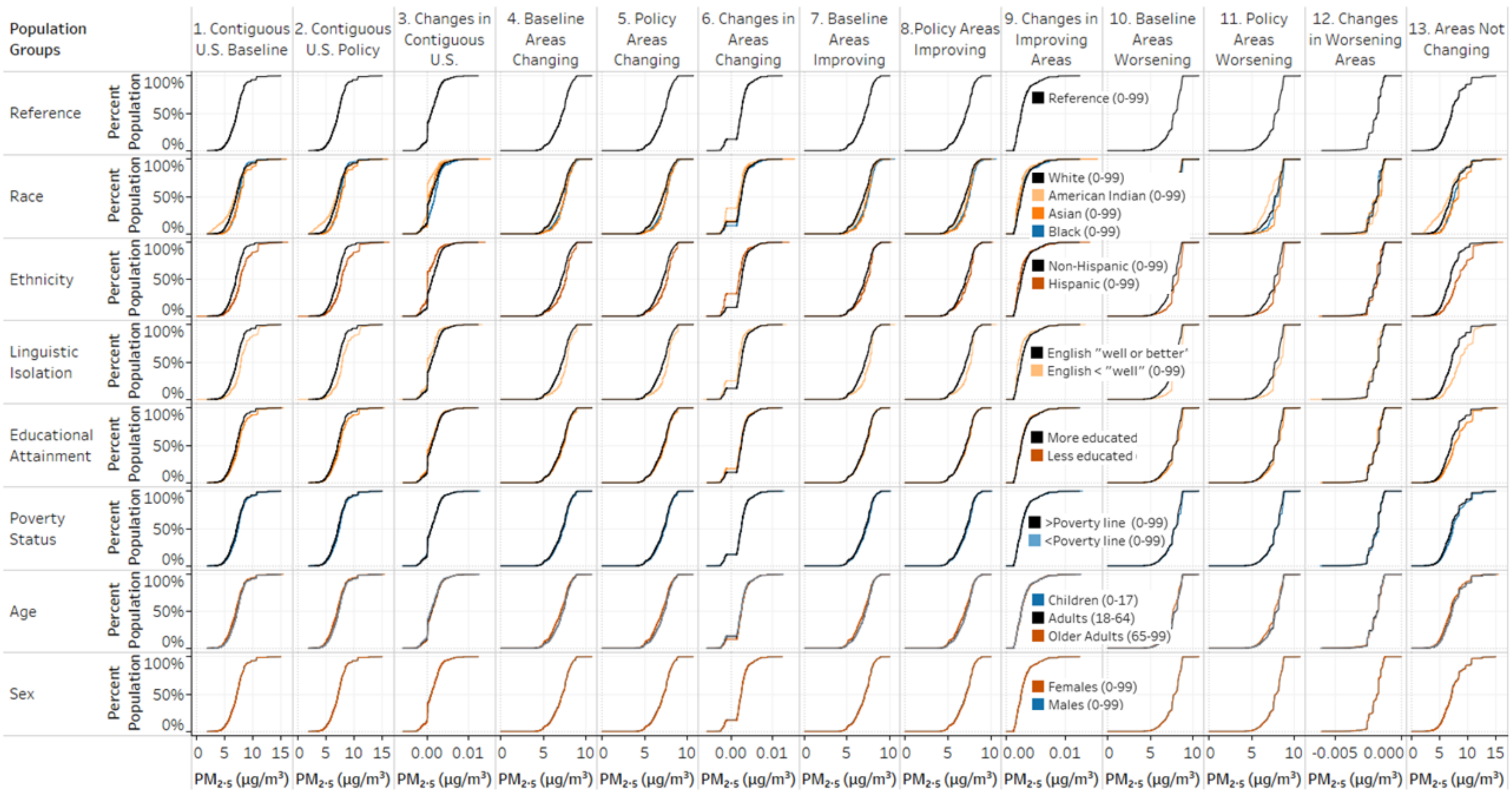

Figure 7. Distribution of Modeled Average Annual $PM_{2.5}$ Concentrations Across Area Categories and Selected Population Groups in 2030

4.2.4 Key Findings

The results of EPA's distributional analysis of air quality impacts indicates that, under the baseline, average annual $PM_{2.5}$ and MDA8 ozone exposures are differentially higher among certain population groups of concern relative to their relevant comparison groups (columns 1, 4, 7, 10, and 13 in Figure 4 and Figure 7). While the regulatory analysis estimating changes in average annual $PM_{2.5}$ and MDA8 ozone exposures shows increases and decreases in pollutant emissions across regions of the United States under the final rule, these changes overall are small and do not change the distribution of air quality impacts observed under the baseline. Therefore, EPA concludes that the air quality changes resulting from the final rule are not expected to mitigate or exacerbate distributional disparities present under the baseline.

4.3 Surface Water

In addition to air emissions, EPA evaluated the distribution of pollutant loadings and the environmental and human health effects of wastewater discharges from steam electric power plants into surface waters. EPA analyzed these impacts in the immediate and downstream reaches of surface waters receiving wastewater discharges. The following sections provide an overview of EPA's methodology for quantifying these impacts and discuss the distribution of these impacts among all affected communities.

4.3.1 Immediate Receiving Waters

The term "immediate receiving water" is used to describe a reach of a surface water where a discharge of wastewater occurs.[32] To evaluate impacts within immediate receiving waters, EPA used the Immediate Receiving Water (IRW) Model which quantitatively assesses potential water quality, wildlife, and human health impacts from estimated pollutant loadings from steam electric power plant discharges.

The IRW Model evaluates water quality impacts by calculating annual average total and dissolved pollutant concentrations[33] in the water column and sediment of immediate receiving waters. It then compares these concentrations to specific water quality criteria values–National Recommended Water Quality Criteria (NRWQC) and MCLs–to assess potential impacts to wildlife and human health. To evaluate potential impacts to wildlife, the model uses the annual average pollutant concentrations in the immediate receiving water to estimate bioaccumulation of pollutants in fish tissue of trophic level[34] 3 (T3) and trophic level 4 (T4) fish.[35] The model then compares these results to benchmark values–threshold effect concentration (TEC) and no effect hazard concentration (NEHC)-to evaluate potential impacts on exposed sediment biota and piscivorous wildlife[36] that consume T3 and T4 fish, respectively. Estimated

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[32] The length of the immediate receiving water, as defined in the National Hydrography Dataset Plus (NHDPlus) Version 2. See the 2024 EA for more details.

[33] The pollutants modeled were arsenic, cadmium, copper, lead, mercury, nickel, selenium, thallium, and zinc.

[34] A trophic level is a sequential stage in a food chain, *i.e.,* producers (T1), primary consumers (T2), secondary consumers (T3), tertiary consumers (T4), and quaternary consumers (T5).

[35] T3 fish (*e.g.,* carp, smelt, perch, catfish, sucker, bullhead, sauger) are those that primarily consume invertebrates and plankton, while T4 fish (*e.g.,* salmon, trout, walleye, bass) are those that primarily consume other fish (U.S. EPA, 2020).

[36] The IRW Model uses minks and eagles to represent impacts to piscivorous wildlife because they live in most of the United Sates and their diets primarily consist of T3 and T4 fish, respectively. Referencing Hinck, J. E., Schmitt, C. J., Chojnacki, K. A., & Tillitt, D. E. (2009). Environmental Contaminants in Freshwater Fish and Their Risk to Piscivorous Wildlife Based on A National Monitoring Program. *Environmental Monitoring and Assessment*, *152*, 469-494. https://doi.org/https://doi.org/10.1007/s10661-008-0331-5 , the 2015 EA states that, "Minks and eagles are commonly used in ecological risk assessments as indicator species for potential impacts to fish-eating mammals and birds in areas contaminated with bioaccumulative pollutants (USGS, 2008)." (U.S. Environmental Protection Agency.

fish tissue concentrations are also used to assess human health impacts–non-cancer and cancer risks – to human populations from consuming fish that are caught in contaminated receiving waters.[37] For a more detailed discussion of the IRW Model see the 2024 EA.

EPA used the IRW Model to evaluate these impacts from steam electric power plant discharges for 114 immediate receiving waters receiving pollutant loadings from 112 plants. The results of the analyses are presented under baseline conditions and for each of the regulatory options. Information on the socioeconomic characteristics[38] of affected communities is included with the results from the model to evaluate the distribution of impacts (relative to the baseline) under the final rule.

4.3.1.1 Distribution of Water Quality Impacts

Using the IRW Model, EPA compared immediate-receiving-water-specific pollutant concentrations in the water column and sediment to benchmark values for NRWQC and MCLs. The benchmarks used for each pollutant were the freshwater acute NRWQC, freshwater chronic NRWQC, human health water and organism NRWQC, human health organism only NRWQC, and drinking water MCL. The comparison of pollutant concentrations to these benchmarks enabled EPA to evaluate the potential for adverse impacts to wildlife and human health for each immediate receiving water. For more information on the methodology EPA used to evaluate water quality impacts, see the 2024 EA and section 4.2.1 of the 2020 EA (U.S. EPA, 2020; 2024b).

Table 14 presents the results of the IRW Model's analysis of water quality impacts. Under the baseline and regulatory options, the table shows the socioeconomic characteristics of communities impacted by immediate receiving waters exceeding pollutant-specific benchmark values, compared to the socioeconomic characteristics of communities impacted by immediate receiving waters without exceedances. This was done to assess whether, under the baseline, communities impacted by immediate receiving waters with pollutant-specific benchmark exceedances have larger populations of low-income individuals and people of color than impacted communities where immediate receiving waters do not have exceedances, and whether this distribution changes under the regulatory options.

(2015a). *Environmental Assessment for the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*. (EPA 821-R-15-006).)

[37] Non-cancer risks are evaluated for all pollutants based on a reference dose (RfD) that represents a dose that is in general protective of human health, as opposed to a dose associated with a specific health endpoint. Cancer risks are calculated only for arsenic, which has a cancer slope factor identified in EPA's Integrated Risk Information System (IRIS). See Appendix E of the 2020 EA (U.S. Environmental Protection Agency. (2020). *Supplemental Environmental Assessment for Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*.).

[38] To analyze the socioeconomic characteristics of communities expected to be impacted by pollutant loadings in immediate receiving waters of steam electric power plants, EPA used the five-year (2017 to 2021) population estimates from the U.S. Census Bureau's ACS dataset. EPA evaluated the percent of the affected population that is low-income, defined in the ACS as the percent of the population below the poverty threshold. EPA also evaluated the demographic characteristic of impacted communities across minority racial and ethnic categories included in the ACS data. These racial and ethnic categories include: African American (non-Hispanic); Asian (non-Hispanic); Native Hawaiian/Pacific Islander (non-Hispanic); American Indian/Alaska Native (non-Hispanic); Other non-Hispanic; Hispanic/Latino.

Table 14. Immediate Receiving Water Community Demographics by Water Quality Benchmark Exceedances under Baseline and the Regulatory Options

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]
Percent Low-Income	12.9%	6.1%	6.1%	7.9%	5.7%	7.5%	5.9%	5.4%	6.1%
Percent African American (non-Hispanic)	12.1%	14.5%	7.2%	16.9%	7.8%	22.6%	7.7%	11.0%	9.4%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	2.2%	1.2%	3.2%	1.1%	4.9%	1.1%	1.0%	1.5%
Percent Asian (non-Hispanic)	5.6%	3.8%	0.9%	0.8%	2.0%	0.5%	1.9%	0.4%	1.8%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	1.5%	1.1%	1.2%	1.2%	1.1%	1.2%	1.0%	1.2%
Percent Hispanic/Latino	19.2%	7.9%	3.5%	4.3%	5.0%	5.3%	4.8%	4.5%	4.9%
Total Population	**333,000,000**	**99,834**	**221,017**	**57,812**	**263,039**	**37,219**	**283,632**	**14,976**	**305,875**
Count of IRW		**38**	**76**	**28**	**86**	**14**	**100**	**7**	**107**

Source: U.S. EPA. 2024. IRW Model Results and Demographic Comparison for the EJ Analysis.

Abbreviations: IRW (immediate receiving water).

a –EPA compared pollutant concentrations in the receiving water attributed to steam electric power plant discharges to pollutant-specific water quality benchmarks to determine exceedances. Evaluated benchmarks include freshwater acute, freshwater chronic, human health water and organism, and human health organism only National Recommended Water Quality Criteria (NRWQC); and drinking water maximum contaminant levels (MCLs). Evaluated pollutants include arsenic, cadmium, copper, lead, mercury, nickel, selenium, thallium, and zinc. See the 2024 EA for more details on the analysis.

Under the baseline, in communities near immediate receiving waters with pollutant-specific benchmark exceedances, the percent of the population identified as African American (non-Hispanic) and American Indian or Alaska Native (non-Hispanic) are above the national average and greater than in communities near immediate receiving waters with no exceedances (Table 14). Additionally, in communities near immediate receiving waters with exceedances, the percent of the population identified as Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino is greater than in communities near immediate receiving waters with no exceedances (Table 14). These results suggest that there are potential EJ concerns under the baseline.

The results of the analysis of the regulatory options show that all options reduce the number of immediate receiving waters with pollutant-specific benchmark exceedances and the people affected by these exceedances compared to the baseline across all population groups of concern, helping to mitigate potential EJ concerns observed under the baseline. Option C generates the largest reductions (Table 14). The improvements estimated under the Option A and Option B accrue at a higher rate to some population groups of concern than other groups, resulting in the remaining immediate receiving waters with exceedances being concentrated among those other groups. Under Option C, the estimated improvements accrue proportionally among all population groups of concern as the percent of the population identified as one of these groups in communities with immediate receiving waters with exceedances is below the national average (except for those identified as American Indian or Alaska Native [non-Hispanic]) and the percent of the population in communities near immediate receiving waters with no exceedances (except for those identified as African American [non-Hispanic]) (Table 14).

Improvements under Option A accrue at a higher rate among people identified as Asian (non-Hispanic), Other (non-Hispanic) and Hispanic or Latino, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option A. The percent of the population identified as one of these demographic groups in communities near immediate receiving waters with exceedances decreases to less than the percent of the population in communities near immediate receiving waters with no exceedances (Table 14). The improvements under Option A accrue at a higher rate among people identified as low-income, African American (non-Hispanic), and American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with exceedances, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option A (Table 14). The percent of the population identified as low-income in communities near immediate receiving waters with exceedances increases to become greater than the percent of the of the population identified as low-income in communities near immediate receiving waters without exceedances. Additionally, the percent of the population identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population identified as African American (non-Hispanic) or American Indian Alaska Native (non-Hispanic) in communities near immediate receiving waters with no exceedances.

Improvements under Option B accrue at a higher rate among people identified as Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option B (Table 14). The percent of the population identified as one of these demographic groups in communities near immediate receiving waters decreases to less than the percent of the population in communities near immediate receiving waters with no exceedances. A decrease is also observed for the percent of the population identified as Hispanic or Latino, although it remains greater than in communities near immediate receiving waters with no exceedances. The improvements estimated under Option B accrue at a lower rate among people identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), and Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with exceedances, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option B (Table 14). The percent of the population identified as low-income or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with exceedances increases to become greater than the percent of the population identified as low-income or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with no exceedances. Additionally, the percent of the population identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population identified as African American (non-Hispanic) or American Indian Alaska Native (non-Hispanic) in communities near immediate receiving waters with no exceedances.

4.3.1.1.1 Distribution of Wildlife Impacts

Once the water quality impacts were assessed, EPA used the IRW Model to evaluate potential wildlife impacts in immediate receiving waters. The IRW Model performs two types of analyses to evaluate potential wildlife impacts. The first is an analysis that compares pollution concentration in sediment of immediate receiving waters to TECs for sediment biota. For the second analysis, the IRW Model calculates the bioaccumulation of pollutants in T3 and T4 fish tissue and compares the fish tissue concentrations to NEHCs for minks and eagles. EPA uses the results of the two analyses to evaluate potential impacts on wildlife from pollutant discharges to the immediate receiving waters. For more information on the methodology EPA used to evaluate wildlife impacts see the 2024 EA and section 4.2.2 of the 2020 EA (U.S. EPA, 2020; 2024b).

The following tables present the results of the analyses on impacts to sediment biota, mink, and eagles. Table 15 through Table 17 present the socioeconomic characteristics of communities with immediate receiving waters with and without sediment pollutant concentrations that exceed the TEC for sediment biota, fish tissue concentrations that exceed the NEHC for mink, and fish tissue concentrations that exceed the NEHC for eagles, respectively, under the baseline and regulatory options. This was done to assess whether, under the baseline, communities impacted by immediate receiving waters with TEC and NEHC exceedances have larger populations of low-income people individuals and people of color than impacted communities where immediate receiving waters do not have exceedances, and whether this distribution changes under the final rule.

Table 15. Immediate Receiving Water Community Demographics by Sediment Benchmark Exceedances under Baseline and the Regulatory Options

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]
Percent Low-Income	12.9%	7.4%	5.9%	7.4%	5.9%	6.9%	6.0%	4.6%	6.2%
Percent African American (non-Hispanic)	12.1%	17.6%	8.0%	17.6%	8.0%	26.1%	7.9%	18.9%	9.0%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	3.8%	1.1%	3.8%	1.1%	6.3%	1.1%	0.9%	1.5%
Percent Asian (non-Hispanic)	5.6%	0.8%	2.0%	0.8%	2.0%	0.4%	1.9%	0.3%	1.9%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	1.2%	1.2%	1.2%	1.2%	1.1%	1.2%	1.1%	1.2%
Percent Hispanic/Latino	19.2%	3.2%	5.2%	3.2%	5.2%	3.8%	5.0%	4.3%	4.9%
Total Population	333,000,000	47,972	272,879	47,972	272,879	28,233	292,618	15,715	305,136
Count of IRW		24	90	24	90	11	103	7	107

Source: U.S. EPA. 2024. IRW Model Results and Demographic Comparison for the EJ Analysis.

Abbreviations: IRW (immediate receiving water).

a –EPA compared pollutant concentrations in the receiving water sediment attributed to steam electric power plant discharges to pollutant-specific threshold effect concentrations (TECs) for sediment biota to determine exceedances. Evaluated pollutants include arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc. See the 2024 EA for more details on the analysis.

Table 16. Immediate Receiving Water Community Demographics NEHC Exceedances for Eagles (Ingesting T4 Fish) under Baseline and the Regulatory Options

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]
Percent Low-Income	12.9%	7.8%	5.8%	6.9%	6.0%	6.0%	6.1%	4.9%	6.1%
Percent African American (non-Hispanic)	12.1%	16.6%	8.4%	11.8%	9.2%	11.8%	9.4%	13.3%	9.3%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	4.3%	1.1%	6.1%	1.1%	12.5%	1.0%	1.1%	1.5%
Percent Asian (non-Hispanic)	5.6%	0.8%	1.9%	1.0%	1.9%	0.3%	1.8%	0.4%	1.8%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	1.2%	1.2%	1.5%	1.2%	1.0%	1.2%	1.1%	1.2%
Percent Hispanic/Latino	19.2%	3.4%	5.1%	3.8%	5.0%	4.9%	4.9%	5.2%	4.9%
Total Population	333,000,000	42,042	278,809	28,968	291,883	13,996	306,855	12,349	308,502
Count of IRW		22	92	17	97	6	108	5	109

Source: U.S. EPA. 2024. IRW Model Results and Demographic Comparison for the EJ Analysis.

Abbreviations: IRW (immediate receiving water); NEHC (no effect hazard concentrations); T4 (trophic level 4).

a –EPA compared fish tissue concentrations (T4) in the receiving water attributed to steam electric power plant discharges to pollutant-specific no effect hazard concentrations (NEHCs) for eagles (ingesting T4 fish) to determine exceedances. Evaluated pollutants include arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc. See the 2024 EA for more details on the analysis.

Note: EPA did not identify an NEHC value for methylmercury. EPA compared the modeled methylmercury concentrations to the total mercury NEHC, which may underestimate the impact to wildlife.

Table 17. Immediate Receiving Water Community Demographics NEHC Exceedances for Mink (Ingesting T3 Fish) under Baseline and the Regulatory Options

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]
Percent Low-Income	12.9%	7.3%	6.0%	7.3%	6.0%	6.0%	6.1%	4.9%	6.1%
Percent African American (non-Hispanic)	12.1%	7.8%	9.6%	7.8%	9.6%	11.8%	9.4%	13.3%	9.3%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	6.7%	1.1%	6.7%	1.1%	12.5%	1.0%	1.1%	1.5%
Percent Asian (non-Hispanic)	5.6%	1.1%	1.8%	1.1%	1.8%	0.3%	1.8%	0.4%	1.8%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	1.5%	1.2%	1.5%	1.2%	1.0%	1.2%	1.1%	1.2%
Percent Hispanic/Latino	19.2%	4.1%	5.0%	4.1%	5.0%	4.9%	4.9%	5.2%	4.9%
Total Population	333,000,000	26,447	294,404	26,447	294,404	13,996	306,855	12,349	308,502
Count of IRW		16	98	16	98	6	108	5	109

Source: U.S. EPA. 2024. IRW Model Results and Demographic Comparison for the EJ Analysis.

Abbreviations: IRW (immediate receiving water); NEHC (no effect hazard concentrations); T3 (trophic level 3).

a –EPA compared fish tissue concentrations (T3) in the receiving water attributed to steam electric power plant discharges to pollutant-specific no effect hazard concentrations (NEHCs) for minks (ingesting T3 fish) to determine exceedances. Evaluated pollutants include arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc. See the 2024 EA for more details on the analysis.

Note: EPA did not identify an NEHC value for methylmercury. EPA compared the modeled methylmercury concentrations to the total mercury NEHC, which may underestimate the impact to wildlife.

Across the sediment biota, eagle, and mink wildlife analyses, under the baseline, the percent of the population identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Other (non-Hispanic) in communities near immediate receiving waters with pollutant-specific benchmark exceedances is greater than the national average and/or the percent of the population in communities near immediate receiving waters with no exceedances (Table 15-Table 17). These results suggest that there are potential EJ concerns under the baseline.

The results of the analysis of regulatory options show that across the sediment biota, eagle, and mink wildlife analyses, none of the options increase the number of immediate receiving waters with pollutant-specific benchmark exceedances for sediment biota, eagle, and mink and the people affected by these exceedances compared to the baseline across all population groups of concern, helping to mitigate potential EJ concerns observed under the baseline (Table 15-Table 17).Option C generates the greatest reduction in the number of immediate receiving waters with exceedances and the people affected by these exceedances relative to the baseline (Table 15-Table 17).

Option A

In the sediment biota and mink wildlife analyses, under Option A, there is no change in the number of immediate receiving waters with exceedances and the population potentially affected by these exceedances relative to the baseline (Table 15 and Table 17).

For the eagle wildlife analysis, the improvements under Option A accrue at a higher rate among people identified as low-income or African American (non-Hispanic), reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option A (Table 16). The percent of the population identified as low-income in communities with immediate receiving waters with exceedances decreases, although it remains greater than the percent of the population identified as low-income in communities near immediate receiving waters with no exceedances. The percent of the population identified as African American (non-Hispanic) in communities with immediate receiving waters with exceedances decreases so that it falls below the national average, although it remains greater than the percent of the population identified as African American (non-Hispanic) in communities with immediate receiving waters with no exceedances. The improvements under Option A accrue at a lower rate to people identified as American Indian or Alaska Native (non-Hispanic) and Other (non-Hispanic), increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option A (Table 16). The percent of the population identified as American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population identified as American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with no exceedances. The percent of the populations identified as Other (non-Hispanic) increases relative to the baseline and becomes greater than the percent of the population identified as Other (non-Hispanic) in communities near immediate receiving waters with no exceedances.

Option B

In the sediment biota wildlife analysis, the improvements under Option B accrue at a higher rate among people identified as low-income in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option B (Table 15). The percent of the population identified as low-income decreases relative to the baseline although it remains greater than the percent of the population identified as low-income in communities near immediate receiving waters with no exceedances. The improvements estimated under Option B accrue at a lower rate to people identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with exceedances, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option B (Table 15). The percent of the population identified as African American (non-Hispanic) or American Indian Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population identified as African American (non-Hispanic) or American Indian Alaska Native (non-Hispanic) in communities near immediate receiving waters with no exceedances.

For the eagle wildlife analysis, the improvements under Option B accrue at a higher rate among people identified as low-income or African American (non-Hispanic) in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option B (Table 16). The percent of the population identified as low-income decreases relative to the baseline and becomes less than the percent of the population identified as low-income in communities near immediate receiving waters with no exceedances. The percent of the population identified as African American (non-Hispanic) also decreases relative to the baseline and becomes less than the national average, although it remains greater than in communities near immediate receiving waters with no exceedances. The improvements estimated under Option B accrue at a lower rate to people identified as American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with exceedances, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option B (Table 16). The percent of the population identified as American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population identified as American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with no exceedances.

In the mink wildlife analysis, the improvements under Option B accrue at a higher rate among people identified as low-income or Other (non-Hispanic) in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option B (Table 17). The percent of the population identified as low-income or Other (non-Hispanic) decreases relative to the baseline and becomes less than the percent of the population identified as low-income or Other (non-Hispanic) in communities near immediate receiving waters with no exceedances. The improvements estimated under Option B accrue at a lower rate among people identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic), increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option B (Table 17). The percent of the population identified as African American (non-Hispanic) increases relative to the baseline and remains greater than the percent of the population identified as African American (non-Hispanic) in communities near immediate receiving waters without exceedances. The percent of the population identified as American Indian or Alaska Native (non-Hispanic) also increases relative to the baseline and remains greater than the national average and the percent of the population identified as American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with no exceedances.

Option C

In the sediment biota wildlife analysis, improvements under Option C accrue at a higher rate among people identified as low-income or American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in communities near the remaining receiving waters with exceedances under Option C (Table 15). Both the percent of the population identified as low-income and the percent of the population identified as American Indian or Alaska Native (non-Hispanic) decrease relative to the baseline and become less than the percent of the population identified as low-income or American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with no exceedances, although the percent of the population identified as American Indian or Alaska Native (non-Hispanic) remains greater than the national average. The improvements estimated under Option C accrue at a lower rate among people identified as African American (non-Hispanic) in communities near immediate receiving waters with exceedances, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option C (Table 15). The percent of the population identified as African American (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population identified as African American (non-Hispanic) in communities near immediate receiving waters with no exceedances.

For the eagle wildlife analysis, improvements under Option C accrue at a higher rate among people identified as low-income, African American (non-Hispanic), or American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with exceedances, reducing their representations relative to the baseline in communities near the remaining receiving waters with exceedances under Option C (Table 16). The percent of the population identified as low-income or American Indian or Alaska Native (non-Hispanic) decreases relative to the baseline and becomes less than the percent of the population identified as low-income or American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with no exceedances, although the percent of the population identified as American Indian or Alaska Native (non-Hispanic) remains greater than the national average. The percent of the population identified as African American (non-Hispanic) decreases relative to the baseline but remains greater than the national average and the percent of the population identified as African American (non-Hispanic) in communities near immediate receiving waters with no exceedances. The improvements estimated under Option C accrue at a lower rate among people identified as Hispanic or Latino in communities near immediate receiving waters with exceedances, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option C (Table 16). The percent of the population identified as Hispanic or Latino increases relative to the baseline and becomes greater than the percent of the population identified as Hispanic or Latino in communities near immediate receiving waters with no exceedances.

In the mink wildlife analysis, the improvements under Option C accrue at a higher rate among people identified as low-income, American Indian or Alaska Native (non-Hispanic), or Other (non-Hispanic) in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in communities near the remaining receiving waters with exceedances under Option C (Table 17). The percent of the population identified as low-income, American Indian or Alaska Native (non-Hispanic), and Other (non-Hispanic) decreases relative the baseline and becomes less than the percent of the population identified as one of these demographic groups in communities near immediate receiving waters with no exceedances, although the percent of the population identified as American Indian or Alaska Native (non-Hispanic) remains greater than the national average. The improvements estimated under Option C accrue at a lower rate among people identified as African American (non-Hispanic) in communities near immediate receiving waters with exceedances, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option C (Table 17). The percent of the population identified as African American (non-Hispanic) increases relative to the baseline and becomes greater than the national average and remains greater than the percent of the population identified as this demographic group in communities near immediate receiving waters with no exceedances.

4.3.1.1.2 Distribution of Human Health Impacts

After impacts to wildlife were evaluated, EPA used the fish tissue concentrations calculated by the IRW Model to assess non-cancer and cancer risks to human populations from consuming fish caught in contaminated immediate receiving waters. Non-cancer and cancer risks are calculated for four human cohorts: child recreational, adult recreational, child subsistence, and adult subsistence. For more information on the methodology EPA used to evaluate human health impacts, see the 2024 EA and section 4.2.3 of the 2020 EA (U.S. EPA, 2020; 2024b).

Non-cancer human health risks are evaluated by comparing the cohort- and pollutant-specific daily intake of a pollutant from fish ingestion—expressed as an average daily dose (mg/kg/day)—to cohort- and pollutant-specific oral reference doses (RfDs). Based on these factors, in each cohort, a hazard quotient (HQ) value is calculated for each immediate receiving water by dividing the average daily dose by the RfDs. If an immediate receiving water has an HQ greater than one (1.0), EPA identifies it as having an exceedance of a non-cancer human health risk.

EPA evaluated cancer human health risks from arsenic by estimating a lifetime average daily dose (LADD) and a corresponding lifetime excess cancer risk (LECR) for each cohort. EPA then compared the LECR to a benchmark of one-in-a-million (1.00×10^{-6}). LECRs are calculated for each immediate receiving water. If an immediate receiving water has an LECR greater than 1.00×10^{-6}, EPA identified it as having an LECR exceedance.

Table 18 and Table 19 show the results from the distributional analysis of the IRW Model's estimated non-cancer and cancer health impacts under the baseline and regulatory options for each cohort. This was done to determine whether, for each cohort, communities with immediate receiving waters with exceedances have a larger proportion of population groups of concern.

Table 18 presents the socioeconomic characteristics of communities with immediate receiving waters with and without HQs greater than one.

Table 18. Immediate Receiving Water Community Demographics by Oral RfD Exceedances under Baseline and the Regulatory Options, organized by Life Stage and Consumer Cohort

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]
Child, Recreational Fisher									
Percent Low-Income	12.9%	7.5%	5.8%	7.7%	5.9%	7.8%	6.0%	4.9%	6.1%
Percent African American (non-Hispanic)	12.1%	15.7%	8.2%	17.3%	8.3%	22.2%	8.5%	12.5%	9.3%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	3.3%	1.1%	4.5%	1.1%	7.6%	1.0%	1.1%	1.5%
Percent Asian (non-Hispanic)	5.6%	0.9%	2.0%	0.9%	1.9%	0.4%	1.9%	0.4%	1.8%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.2%	0.1%	0.2%	0.1%	0.3%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	1.1%	1.3%	1.3%	1.2%	0.9%	1.3%	1.1%	1.2%
Percent Hispanic/Latino	19.2%	4.3%	5.0%	3.7%	5.1%	4.4%	4.9%	5.0%	4.9%
Total Population	333,000,000	55,285	265,566	40,284	280,567	23,522	297,329	13,194	307,657
Count of IRW		28	86	22	92	9	105	6	108
Adult, Recreational Fisher									
Percent Low-Income	12.9%	7.4%	5.8%	6.8%	6.0%	5.2%	6.1%	3.9%	6.2%
Percent African American (non-Hispanic)	12.1%	16.0%	8.2%	11.0%	9.3%	8.9%	9.5%	10.2%	9.4%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	3.5%	1.1%	5.8%	1.1%	13.5%	1.0%	0.7%	1.5%

Table 18. Immediate Receiving Water Community Demographics by Oral RfD Exceedances under Baseline and the Regulatory Options, organized by Life Stage and Consumer Cohort

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]
Percent Asian (non-Hispanic)	5.6%	0.9%	1.9%	1.0%	1.9%	0.4%	1.8%	0.4%	1.8%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	1.2%	1.2%	1.4%	1.2%	1.1%	1.2%	1.3%	1.2%
Percent Hispanic/Latino	19.2%	4.4%	5.0%	3.7%	5.0%	5.2%	4.9%	5.6%	4.9%
Total Population	333,000,000	52,429	268,422	30,873	289,978	12,471	308,380	10,824	310,027
Count of IRW		26	88	18	96	6	108	5	109
Child, Subsistence Fisher									
Percent Low-Income	12.9%	6.3%	6.0%	7.4%	5.8%	7.4%	5.9%	5.3%	6.1%
Percent African American (non-Hispanic)	12.1%	15.9%	6.8%	15.2%	8.2%	21.5%	7.8%	9.7%	9.5%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	2.2%	1.2%	3.3%	1.1%	4.7%	1.1%	0.9%	1.6%
Percent Asian (non-Hispanic)	5.6%	3.7%	1.0%	0.1%	2.0%	0.5%	2.0%	0.3%	1.9%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	1.9%	1.0%	1.1%	1.2%	1.1%	1.2%	0.9%	1.2%

Table 18. Immediate Receiving Water Community Demographics by Oral RfD Exceedances under Baseline and the Regulatory Options, organized by Life Stage and Consumer Cohort

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]
Percent Hispanic/Latino	19.2%	8.9%	3.2%	4.2%	5.1%	5.1%	4.9%	4.1%	4.9%
Total Population	333,000,000	94,751	226,100	58,368	262,483	39,124	281,727	16,881	303,970
Count of IRW		39	75	28	86	15	99	8	106
Adult, Subsistence Fisher									
Percent Low-Income	12.9%	7.8%	5.7%	7.7%	5.8%	7.8%	6.0%	4.9%	6.1%
Percent African American (non-Hispanic)	12.1%	15.2%	8.1%	15.9%	8.4%	22.2%	8.5%	12.5%	9.3%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	3.2%	1.1%	4.1%	1.1%	7.6%	1.0%	1.1%	1.5%
Percent Asian (non-Hispanic)	5.6%	0.8%	2.0%	0.8%	1.9%	0.4%	1.9%	0.4%	1.8%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.1%	0.1%	0.1%	0.1%	0.3%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	1.2%	1.2%	1.2%	1.2%	1.0%	1.2%	1.1%	1.2%
Percent Hispanic/Latino	19.2%	5.2%	4.8%	3.3%	5.1%	4.4%	4.9%	5.0%	4.9%
Total Population	333,000,000	62,762	258,089	43,947	276,904	23,522	297,329	13,194	307,657
Count of IRW		31	83	23	91	9	105	6	108

Source: U.S. EPA. 2024. IRW Model Results and Demographic Comparison for the EJ Analysis.

Abbreviations: IRW (immediate receiving water); RfD (reference dose).

a –EPA compared the human health cohort's daily intake of a pollutant from ingesting fish from the receiving water to pollutant-specific oral reference doses (RfDs) to determine exceedances. Evaluated pollutants include arsenic (inorganic), cadmium, copper, mercury (as methylmercury), nickel, selenium, and zinc. See the 2024 EA for more details on the analysis.

Child Recreational Consumption

Under the baseline, the percent of the population identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic) children in communities near immediate receiving waters with non-cancer HQs greater than one is greater than the national average and the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one (Table 18). These results suggests that there are potential EJ concerns under the baseline.

The results of the analysis of regulatory options show that all options reduce the number of immediate receiving waters with non-cancer HQs greater than one and the population of children affected by these HQ exceedances compared to the baseline, helping to mitigate potential EJ concerns observed under the baseline (Table 18). Option C generates the largest reductions (Table 18).

Improvements under Option A accrue at a lower rate among children identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with non-cancer HQs greater than one, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option A (Table 18). The percent of the population of children identified as low-income or Native Hawaiian or Pacific (Islander (non-Hispanic) increases relative to the baseline and remains greater than the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the population of children identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one.

Improvements under Option B accrue at a lower rate among children identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with non-cancer HQs greater than one, increasing their representation relative to the baseline in communities near their remaining immediate receiving waters with non-cancer HQs greater than one under Option B (Table 18). The percent of the population of children identified as low-income increases relative to the baseline and remains greater than the percent of the population identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the population of children identified as Native Hawaiian Pacific Islander (non-Hispanic) increases relative to the baseline and becomes greater than the national average and remains greater than the percent of the population of children identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one. Lastly, the percent of the population of children identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one.

Improvements under Option C accrue at a higher rate among children identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option C (Table 18). The percent of the population of children identified as one of these demographic groups decreases relative to the baseline, although the percent of the population of children identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) remain greater than the national average and the percent of the population of children identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters without non-cancer HQs greater than one. The improvements estimated under Option C accrue at a lower rate to children identified as Hispanic or Latino, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option C (Table 18). The percent of the population of children identified as this demographic group increases relative to the baseline and becomes greater than the percent of the population identified as Hispanic or Latino in communities near immediate receiving waters without non-cancer HQs greater than one.

Adult Recreational Consumption

Under the baseline, the percent of the population identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic) adults in communities near immediate receiving waters with non-cancer HQs greater than one is greater than the national average and/or the percent of the population of adults identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one (Table 18). This suggests that there are potential EJ concerns under the baseline. The results of the analysis of regulatory options show that all options reduce the number of immediate receiving waters with non-cancer HQs greater than one and the population of adults affected by these HQ exceedances compared to the baseline across all population groups of concern, helping to mitigate potential EJ concerns observed under the baseline (Table 18). Option C generates the largest reductions (Table 18).

Improvements under Option A accrue at a higher rate to adults identified as low-income, African American (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option A (Table 18). The percent of the population of adults identified as low-income decreases relative to the baseline, although it remains greater than the percent of the population of adults identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the population of adults identified as African American (non-Hispanic) decreases relative to the baseline and becomes less than the national average but remains greater than the percent of the population of adults identified as this demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one. Lastly, the percent of the population of adults identified as Native Hawaiian or Pacific Islander (non-Hispanic) decreases relative to the baseline and becomes less than the percent of the population of adults identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one. The improvements estimated under Option A accrue at a lower rate to adults identified as American Indian or Alaska Native (non-Hispanic) and Other (non-Hispanic), increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option A (Table 18). The percent of the population of adults identified as American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population of adults identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the population of adults identified as Other (non-Hispanic) also increases relative to the baseline and becomes greater than the percent of the population of adults identified as Other(non-Hispanic) in communities near immediate receiving waters without non-cancer HQs greater than one.

Improvements under Option B accrue at a higher rate to adults identified as low-income, African American (non-Hispanic), and Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option B. Both the percent of the adult population identified as low-income or Native Hawaiian or Pacific Islander (non-Hispanic) decreases relative to the baseline and becomes less than the percent of the adult population identified as these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one. Additionally, the percent of the adult population identified as African American (non-Hispanic) decreases relative to the baseline and becomes less than the national average and the percent of the adult population identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one. The improvements estimated under Option B accrue at a lower rate to adults identified as American Indian or Alaska Native (non-Hispanic) or Hispanic or Latino, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option B (Table 18). The percent of the adult population identified as American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the adult population identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the adult population identified as Hispanic or Latino increases relative to the baseline and becomes greater than the percent of the adult population identified as Hispanic or Latino in communities near immediate receiving waters without non-cancer HQs greater than one.

Improvements under Option C accrue at a higher rate to adults identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option C (Table 18). The percent of the adult population identified as low-income or Native Hawaiian or Pacific Islander (non-Hispanic) decreases relative to the baseline and becomes less than the percent of the adult population identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the adult population identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) decreases relative to the baseline but remains greater than the national average and the percent of the adult population identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one. The improvements estimated under Option C accrue at a lower rate to adults identified as Other (non-Hispanic) or Hispanic or Latino, increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option C (Table 18). The percent of the adult population identified as Other (non-Hispanic) or Hispanic or Latino increases relative to the baseline and becomes greater than the percent of the adult population identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQ exceedances.

Child Subsistence Consumption

Under the baseline, the percent of the population identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Asian (non-Hispanic), Other (non-Hispanic), or Hispanic or Latino children in communities near immediate receiving waters with non-cancer HQs greater than one is greater than the national average and/or the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one (Table 18). This suggests that there are potential EJ concerns under the baseline.

The results of the analysis of regulatory options show that all options reduce the number of immediate receiving waters with non-cancer HQs greater than one and the number of children affected by these HQ exceedances compared to the baseline across all population groups of concerns, helping to mitigate potential EJ concerns observed under the baseline (Table 18). Option C generates the largest reductions (Table 18).

Improvements under Option A accrue at a higher rate to children identified as African American (non-Hispanic), Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option A (Table 18). The percent of the population of children identified as Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino decreases relative to the baseline and becomes less than the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the population of children identified as African American (non-Hispanic) decreases relative to the baseline but remains greater than the national average and the percent of the population of children identified as African American (non-Hispanic) in communities near immediate receiving waters without non-cancer HQs greater than one. The improvements estimated under Option A accrue at a lower rate to children identified as low-income or American Indian or Alaska Native (non-Hispanic), increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option A (Table 18). The percent of the population of children identified as low-income increases relative to the baseline and remains greater than the percent of the population of children identified as low-income in communities near immediate receiving waters without non-cancer HQs greater than one. Lastly, the percent of the population of children identified as American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population of children identified as this demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one.

Improvements under Option B accrue at a higher rate to children identified as Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option B (Table 18). The percent of the population of children identified as Asian (non-Hispanic) or Other (non-Hispanic) decreases relative to the baseline and becomes less than the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the population of children identified as Hispanic or Latino also decreases but remains greater than the percent of the population of children identified as Hispanic or Latino in communities near immediate receiving waters without non-cancer HQs greater than one. The improvements estimated under Option B accrue at a lower rate to children identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic), increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option B (Table 18). The percent of the population of children identified as low-income or Native Hawaiian or Pacific Islander (non-Hispanic) increases relative to the baseline and remains greater than and becomes greater than the percent of the population of children identified as low-income or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters without non-cancer HQs greater than one, respectively. The percent of the population of children identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one.

Improvements under Option C accrue at a higher rate to children identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Asian (non-Hispanic), Other (non-Hispanic), or Hispanic or Latino in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option C (Table 18). The percent of the population of children identified as low-income, Asian (non-Hispanic), Other (non-Hispanic), or Hispanic or Latino decreases relative to the baseline and becomes less than the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQ greater than one. The percent of the population of children identified as African American (non-Hispanic) decreases relative to the baseline and becomes less than the national average but remains greater than the percent of the population of children identified as African American (non-Hispanic) in communities near immediate receiving waters without non-cancer HQs greater than one. Lastly, the percent of the population of children identified as American Indian or Alaska Native (non-Hispanic) decreases relative to the baseline to become less than the percent of the population of children identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one but remains greater than the national average.

Adult Subsistence Consumption

Under the baseline, the percent of the population identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Hispanic or Latino adults in communities near immediate receiving waters with non-cancer HQs greater than one is greater than the national average and/or the percent of the population of adults identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one (Table 18). This suggests that there are potential EJ concerns under the baseline.

The results of the analysis of regulatory options show that all options reduce the number of immediate receiving waters with non-cancer HQs greater than one and the number of adults affected by these HQ exceedances compared to the baseline across all population groups of concern, helping to mitigate potential EJ concerns observed under the baseline (Table 18). Option C generates the largest reductions (Table 18).

Improvements under Option A accrue at a higher rate to adults identified as low-income or Hispanic or Latino in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option A (Table 18). The percent of the adult population identified as low-income or Hispanic or Latino decreases relative to the baseline. The percent of the adult population identified as Hispanic or Latino becomes less than the percent of the adult population identified as Hispanic or Latino in communities near immediate receiving waters without non-cancer HQs greater than one, while the percent of the adult population identified as low-income remains greater than the percent of the adult population identified as low-income in communities near immediate receiving waters without non-cancer HQs greater than one. Improvements estimated under Option A accrue at a lower rate to adults identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic), increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option A (Table 20). The percent of the adult population identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the adult population identified as one of the demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one.

Improvements under Option B accrue at a higher rate to adults identified as Hispanic or Latino in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option B (Table 18). The percent of the adult population identified as Hispanic or Latino decreases relative to the baseline and becomes less than the percent of the adult population identified as Hispanic or Latino in communities near immediate receiving waters without non-cancer HQs greater than one. The improvements estimated under Option B accrue at a lower rate to adults identified as African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic), increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option B (Table 18). The percent of the adult population identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) increases relative to the baseline and remains greater than the national average and the percent of the adult population identified as one of these demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the adult population identified as Native Hawaiian or Pacific Islander (non-Hispanic) increases relative to the baseline and becomes greater than the national average and the percent of the adult population identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one.

Improvements under Option C accrue at a higher rate to adults identified as low-income, African American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), or Hispanic or Latino in communities near immediate receiving waters with non-cancer HQs greater than one, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with non-cancer HQs greater than one under Option C (Table 18). The percent of the adult population identified as low-income decreases relative to the baseline to become less than the percent of the adult population identified as low-income in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the adult population identified as Hispanic or Latino decreases relative to the baseline but remains greater than the percent of the adult population identified as Hispanic or Latino in communities near immediate receiving waters without non-cancer HQs greater than one. The percent of the adult population identified as African American (non-Hispanic) also decreases relative to the baseline and becomes less than the national average but remains greater than the percent of the adult population identified as this demographic group in communities near immediate receiving waters without non-cancer HQs greater than one. Lastly, the percent of the adult population identified as American Indian or Alaska Native (non-Hispanic) decreases relative to the baseline but remains greater than the national average and the percent of the adult population identified as this demographic groups in communities near immediate receiving waters without non-cancer HQs greater than one.

Table 19. Immediate Receiving Water Community Demographics by Lifetime Excess Cancer Risk (LECR) Exceedances Above 1.00 x 10-6 for Arsenic under Baseline and the Regulatory Options, organized by Life Stage and Consumer Cohort

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances	IRW with Exceedances[a]	IRW without Exceedances[a]
Adult, Recreational Fisher									
Percent Low-Income	12.9%	11.2%	6.0%	3.2%	6.1%	3.2%	6.1%	3.2%	6.1%
Percent African American (non-Hispanic)	12.1%	0.1%	9.7%	0%	9.6%	0%	9.6%	0%	9.6%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	23.7%	1.0%	1.0%	1.5%	1.0%	1.5%	1.0%	1.5%
Percent Asian (non-Hispanic)	5.6%	0%	1.8%	0%	1.8%	0%	1.8%	0%	1.8%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	1.1%	1.2%	2.1%	1.2%	2.1%	1.2%	2.1%	1.2%
Percent Hispanic/Latino	19.2%	3.1%	4.9%	4.7%	4.9%	4.7%	4.9%	4.7%	4.9%
Total Population	333,000,000	6,973	313,878	3,763	317,088	3,763	317,088	3,763	317,088
Count of IRW		4	110	2	112	2	112	2	112
Child, Subsistence Fisher									
Percent Low-Income	12.9%	10.3%	6.0%	3.2%	6.1%	5.3%	6.1%	5.3%	6.1%
Percent African American (non-Hispanic)	12.1%	0%	9.6%	0%	9.6%	0%	9.5%	0%	9.5%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	0.7%	1.5%	1.0%	1.5%	0%	1.5%	0%	1.5%

Table 19. Immediate Receiving Water Community Demographics by Lifetime Excess Cancer Risk (LECR) Exceedances Above 1.00 x 10-6 for Arsenic under Baseline and the Regulatory Options, organized by Life Stage and Consumer Cohort

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances	IRW with Exceedances[a]	IRW without Exceedances[a]
Percent Asian (non-Hispanic)	5.6%	0%	1.8%	0%	1.8%	0%	1.8%	0%	1.8%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.2%	0.1%	0.1%	0.1%	0%	0.1%	0%	0.1%
Percent Other (non-Hispanic)	3.5%	1.5%	1.2%	2.1%	1.2%	0%	1.2%	0%	1.2%
Percent Hispanic/Latino	19.2%	3.3%	4.9%	4.7%	4.9%	3.9%	4.9%	3.9%	4.9%
Total Population	333,000,000	5,326	315,525	3,763	317,088	1,237	319,614	1,237	319,614
Count of IRW		3	111	2	112	1	113	1	113
Adult, Subsistence Fisher									
Percent Low-Income	12.9%	8.1%	6.0%	10.3%	6.0%	3.2%	6.1%	3.2%	6.1%
Percent African American (non-Hispanic)	12.1%	2.8%	9.8%	0%	9.6%	0%	9.6%	0%	9.6%
Percent American Indian/Alaska Native (non-Hispanic)	0.6%	11.3%	1.0%	0.7%	1.5%	1.0%	1.5%	1.0%	1.5%
Percent Asian (non-Hispanic)	5.6%	1.6%	1.8%	0%	1.8%	0%	1.8%	0%	1.8%
Percent Native Hawaiian/Pacific Islander (non-Hispanic)	0.2%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	3.5%	2.2%	1.2%	1.5%	1.2%	2.1%	1.2%	2.1%	1.2%

Table 19. Immediate Receiving Water Community Demographics by Lifetime Excess Cancer Risk (LECR) Exceedances Above 1.00 x 10-6 for Arsenic under Baseline and the Regulatory Options, organized by Life Stage and Consumer Cohort

	National Average	Baseline		Option A		Option B		Option C	
		IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances[a]	IRW with Exceedances[a]	IRW without Exceedances	IRW with Exceedances[a]	IRW without Exceedances[a]
Percent Hispanic/Latino	19.2%	4.1%	4.9%	3.3%	4.9%	4.7%	4.9%	4.7%	4.9%
Total Population	333,000,000	14,767	306,084	5,326	315,525	3,763	317,088	3,763	317,088
Count of IRW		9	105	3	111	2	112	2	112

Source: U.S. EPA. 2024. IRW Model Results and Demographic Comparison for the EJ Analysis.

Abbreviations: IRW (immediate receiving water); LECR (lifetime excess cancer risk); NA (not applicable).

a –EPA compared the human health cohort's lifetime average daily dose of the pollutant (*i.e.*, arsenic) from fish ingestion (multiplied by the cancer slope factor) to the LECR of one-in-a-million to determine exceedances. See the 2024 EA for more details on the analysis.

Adult Recreational Consumption

Under the baseline, the percent of the population identified as low-income or American Indian or Alaska Native (non-Hispanic) adults in communities near immediate receiving waters with arsenic LECR exceedances than the national average and/or the percent of the population of adults identified as one of these demographic groups in communities near immediate receiving waters without arsenic LECR exceedances (Table 19). This suggests that there are potential EJ concerns under the baseline.

The results of the analysis show that all of the regulatory options reduce the number of immediate receiving waters with arsenic LECR exceedances and the number of adults affected by these exceedances relative to the baseline across all population groups of concern, helping to mitigate potential EJ concerns observed under the baseline (Table 19). Options A, B, and C all result in the same number of reductions in immediate receiving waters with exceedances (Table 19).

Improvements under Options A, B, and C accrue at a higher rate to adults identified as low-income, African American (non-Hispanic), or American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Options A, B, and C (Table 19). The percent of the adult population identified as low-income decreases relative to the baseline and becomes less than the percent of the adult population identified as low-income in communities near immediate receiving waters without exceedances. The percent of the adult population identified as African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) also decreases relative to the baseline and becomes less than the national average and the percent of the adult population identified as one of these demographic groups in communities near immediate receiving waters without exceedances. The improvements estimated under Options A, B, and C accrue at a lower rate to adults identified as Other (non-Hispanic), increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option A, B, and C (Table 19). The percent of the adult population identified as Other (non-Hispanic) increases relative to the baseline and becomes greater than the percent of the adult population identified as this demographic group in communities near immediate receiving waters without exceedances.

Child Subsistence Consumption

Under the baseline, the percent of the population identified as low-income, American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic) children in communities near immediate receiving waters with arsenic LECR exceedances is greater than the national average and/or the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without arsenic LECR exceedances (Table 19). This suggests that there are potential EJ concerns under the baseline.

The results of the analysis show that all of the regulatory options reduce the number of immediate receiving waters with arsenic LECR exceedances and the number of children affected by these exceedances relative to the baseline across all population groups of concern, helping to mitigate potential EJ concerns observed under the baseline (Table 19). Options B and C result in the most reductions in immediate receiving waters with exceedances (Table 19).

Improvements under Option A accrue at a higher rate to children identified as low-income or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option A (Table 19). The percent of the population of children identified as both of these demographic groups decreases relative to the baseline and becomes less than the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without exceedances. The improvements estimated under Option A accrue at a lower rate to children identified as American Indian or Alaska Native (non-Hispanic) and Other (non-Hispanic), increasing their representation relative to the baseline in communities near the immediate receiving waters with exceedances under Option A (Table 19). The percent of the population of children identified as American Indian or Alaskan Native (non-Hispanic) increases relative to the baseline and remains greater than the national average. The percent of the population of children identified as Other (non-Hispanic) increases relative to the baseline and remains greater than the percent of the population of children identified as this demographic group in communities near immediate receiving waters without exceedances.

Improvements under Options B and C accrue at a higher rate to children identified as low-income, American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic), or Native Hawaiian or Pacific Islander (non-Hispanic) in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in the communities near remaining immediate receiving waters with exceedances under Options B and C (Table 19). The percent of the population of children identified as one of these demographic groups decreases relative to the baseline and becomes less than the national average and/or the percent of the population of children identified as one of these demographic groups in communities near immediate receiving waters without exceedances.

Adult Subsistence Consumption

Under the baseline, the percent of the population identified as low-income, American Indian or Alaska Native (non-Hispanic) or Other (non-Hispanic) in communities near immediate receiving waters with arsenic LECR exceedances is greater than the national average and/or the percent of the adult population identified as one of these demographic groups in communities near immediate receiving waters without arsenic LECR exceedances (Table 19). This suggests that there are potential EJ concerns under the baseline. The results of the analysis of regulatory options show that all options reduce the number of immediate receiving waters with arsenic LECR exceedances and the number of adults affected by these exceedances compared to the baseline across all population groups of concern, helping to mitigate potential EJ concerns observed under the baseline (Table 19). Options B and C generate the largest reductions (Table 19).

Improvements under Option A accrue at a higher rate to adults identified as American Indian or Alaska Native (non-Hispanic), or Other (non-Hispanic) in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option A (Table 19). The percent of the adult population identified as American Indian or Alaska Native (non-Hispanic) decreases relative to the baseline to become less than the national average and the percent of the adult population identified as this demographic group in communities near immediate receiving waters without exceedances. The percent of the adult population identified as Other (non-Hispanic) decreases relative to the baseline but remains greater than the percent of the adult population identified as Other (non-Hispanic) in communities near immediate receiving waters without exceedances. The improvements estimated under Option A accrue at a lower rate to adults identified as low-income or Native Hawaiian or Pacific Islander (non-Hispanic), increasing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option A (Table 19). The percent of the adult population identified as low-income increases relative to the baseline and remains greater than the percent of the population identified as low-income in communities near immediate receiving waters without exceedances. The percent of the adult population identified as Native Hawaiian or Pacific Islander (non-Hispanic) also increases relative to the baseline and becomes greater than the percent of the adult population identified as this demographic group in communities near immediate receiving waters without exceedances.

Improvements under Options B and C accrue at a higher rate to adults identified as low-income, American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic) or Hispanic or Latino in communities near immediate receiving waters with exceedances, reducing their representation relative to the baseline in communities near the remaining immediate receiving waters with exceedances under Option B and C (Table 19). The percent of the adult population identified as low-income decreases relative to the baseline and becomes less than the percent of the adult population identified as low-income in communities near immediate receiving waters without exceedances. The percent of the adult population identified as Other (non-Hispanic) decreases relative to the baseline but remains greater than the percent of the adult population identified as Other (non-Hispanic) in communities near immediate receiving waters without exceedances. The percent of the adult population identified as American Indian or Alaska Native (non-Hispanic) also decreases relative to the baseline and becomes less than the percent of the adult population identified as American Indian or Alaska Native (non-Hispanic) in communities near immediate receiving waters without exceedances but remains greater than the national average. Lastly, while the percent of the adult population identified as Hispanic or Latino increases relative to the baseline, it remains less than the percent of the population identified as Hispanic or Latino in communities near immediate receiving waters without exceedances.

4.3.1.1.3 Key Conclusions

Based on the results of the distributional analyses of water quality, wildlife, and human health impacts, EPA determined that under the baseline distributional disparities were most often observed among affected African American (non-Hispanic) or American Indian or Alaska Native (non-Hispanic) populations when comparing the percent of the population affected in communities with immediate receiving waters benchmark exceedances to the national average and to communities with immediate receiving waters without benchmark exceedances. This, along with distributional disparities observed under the baseline for other population groups of concern, indicates the presence of potential EJ concerns under the baseline across the three analyses. Analyzing the regulatory options across the analyses, EPA found that all the regulatory options reduced the amount of immediate receiving waters with benchmark exceedances and the population affected by these exceedances, with Option C often generating the largest reductions. The improvements estimated under the regulatory options accrue at different rates depending on the population group of concern. Due to disparities under the baseline, population groups of concern that experience improvements at a less than proportional rate were found to be represented to a greater extent in communities near the remaining immediate receiving waters with benchmark exceedances relative to the baseline.

4.3.2 Downstream Surface Waters

Following the approach used for the 2023 proposed rule, EPA used the D-FATE model to estimate the concentrations of pollutants in downstream reaches of surface waters receiving steam electric power plant discharges to support the analysis of the benefits for the final rule. EPA used these concentrations to estimate fish tissue pollutant concentrations[39] under the baseline and regulatory options. For more information on the D-FATE model and the analysis of downstream pollutant and fish tissue concentrations, see the BCA (U.S. EPA, 2024a).

EPA used the modeled fish tissue concentrations as inputs to evaluate human health risks to populations consuming self-caught fish, because the Agency expects recreational and subsistence fishers (and their household members) who consume fish caught in the downstream reaches of receiving waters of steam electric power plant discharges to be affected by changes in fish tissue pollutant concentrations. EPA evaluated the human health effects of exposure to three pollutants known to accumulate in fish tissue among relevant cohorts under the baseline and regulatory options from 2025 to 2049:

- Lead exposure from fish consumption: This analysis evaluated two health endpoints from lead exposure through recreational and subsistence fish consumption: (1) potential neurological and cognitive impacts to children (ages 0-7) in terms of avoided intelligence quotient (IQ) point losses from exposure to lead through recreational and subsistence fish consumption, and (2) avoided cardiovascular disease (CVD) premature mortality in adults (ages 40-80).

[39] As described in Section 4.4, EPA also used D-FATE to estimate changes in pollutant concentrations in source waters.

- **Mercury exposure from fish consumption:** This analysis evaluated potential neurological and cognitive impacts to infants exposed to mercury *in utero* due to maternal fish consumption in terms of avoided IQ point losses.
- **Arsenic exposure from fish consumption:** This analysis evaluated potential cancer risk impacts to adults, expressed as avoided cancer cases.

As part of these analyses, EPA disaggregated health effects within cohorts by racial and ethnic population group (White, Black, Hispanic, Asian, American Indian and Alaska Native, Other[40]) and by income group (above the poverty line or below the poverty line). EPA did this to facilitate an evaluation of the distribution of health effects within and among these groups to determine where there are differential, and potentially disproportionate, and adverse health impacts to population groups of concern under the baseline and regulatory options. The results of the analysis are discussed below.

4.3.2.1 Distribution of Health Impacts Among Children Exposed to Lead through Fish Consumption

As detailed in the BCA, the total avoided IQ point losses for children exposed to lead are very small, approximately one IQ point across the entire exposed population of 1,555,558 children and under all regulatory options (see Table 5-4 in U.S. EPA, 2024a). Given this, EPA determined that reporting small fractional changes across racial and ethnic population groups or by income group would not be informative. However, EPA expects children of color, low-income, and Indigenous peoples to receive shares of the avoided IQ point losses benefits proportional to their exposure.

4.3.2.2 Distribution of Health Impacts Among Adults Exposed to Lead through Fish Consumption

As detailed in the BCA, the total number of avoided CVD deaths for all adults (age 40-80) in the scope of the analysis across the timeframe of the analysis ranges from 0.42 avoided CVD deaths to 1.13 avoided CVD deaths (see Table 5-7 in U.S. EPA, 2024a). Therefore, EPA determined that reporting small fractional changes across racial and ethnic population groups or by income group would not be informative. However, EPA expects adults of color, low-income, and Indigenous populations to receive shares of the CVD premature mortality risk reduction proportional to their exposure.

4.3.2.3 Distribution of Health Impacts Among Infants Exposed to Mercury Through Fish Consumption

As detailed in the BCA, the total number of avoided IQ point losses for the estimated 201,850 infants exposed to mercury *in utero* from maternal fish consumption ranges from 1,190 under Option A to 1,393 under Option C (see Table 5-8 in U.S. EPA, 2024a). Table 20 presents the estimated distribution of the total IQ point losses under the baseline and the avoided IQ point losses under each regulatory option, for infants of subsistence and recreational fish consumers, by race and ethnic population group.

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[40] The "Other" category includes populations that identify as Native Hawaiian and Other Pacific Islander, some other race alone, and two or more races, based on 2021 American Community Survey data (U.S. Census Bureau. (2022a). *American Community Survey (ACS)*. https://www.census.gov/programs-surveys/acs).

Table 20. Modeled Total IQ Point Losses Under the Baseline and Avoided IQ Point Losses under the Regulatory Options Among Infants of Subsistence and Recreational Fish Consumers Exposed to Mercury *in Utero*, by Racial or Ethnic Population Group

Cohort Group	Race/Ethnic Group	Exposed Population[a]	Baseline Total IQ Points Losses[b]	Avoided IQ Point Losses (% Across Cohort Group)		
				Option A	Option B	Option C
Subsistence	White (non-Hispanic)	7,944 (61.3%)	50,271 (53.5%)	125 (62.5%)	145 (62.8%)	146 (62.7%)
	African American (non-Hispanic)	2,270 (17.5%)	15,864 (16.9%)	26 (13.2%)	30 (13.2%)	31 (13.3%)
	Asian (non-Hispanic)	452 (3.5%)	5,408 (5.8%)	8 (4.0%)	9 (4.0%)	9 (4.0%)
	American Indian and Alaska Native (non-Hispanic)	48 (0.4%)	574 (0.6%)	1 (0.7%)	2 (0.7%)	2 (0.7%)
	Other (non-Hispanic)	452 (3.5%)	5,410 (5.8%)	12 (5.8%)	14 (5.9%)	14 (5.9%)
	Hispanic	1,796 (13.9%)	16,492 (17.5%)	27 (13.7%)	31 (13.4%)	31 (13.5%)
Recreational	White (non-Hispanic)	115,766 (61.3%)	258,337 (55.6%)	641 (64.7%)	745 (65.0%)	752 (64.9%)
	African American (non-Hispanic)	33,085 (17.5%)	84,768 (18.2%)	141 (14.2%)	163 (14.2%)	165 (14.3%)
	Asian (non-Hispanic)	6,582 (3.5%)	21,015 (4.5%)	31 (3.2%)	36 (3.1%)	36 (3.1%)
	American Indian and Alaska Native (non-Hispanic)	699 (0.4%)	2,229 (0.5%)	6 (0.6%)	6 (0.5%)	7 (0.6%)
	Other (non-Hispanic)	6,580 (3.5%)	21,025 (4.5%)	45 (4.6%)	53 (4.6%)	53 (4.6%)
	Hispanic	26,176 (13.9%)	77,157 (16.6%)	127 (12.9%)	144 (12.5%)	146 (12.6%)
Total		**201,850**	**575,042**	**1,190**	**1,377**	**1,393**

Source: U.S. EPA analysis, 2024.

Notes:

The exposed population for each racial/ethnic population group is presented as the number of infants exposed and (in parenthesis) the number of infants exposed as a share of the entire cohort.

The baseline total IQ point losses for each racial/ethnic population group are presented as the total number of IQ point losses and (in parenthesis) the total number of IQ point losses as a share of the total number of IQ point losses for the entire cohort.

The results of the distributional analysis of neurological and cognitive health impacts among both infants of mothers who are subsistence and recreational fish consumers indicates potential EJ concerns under the baseline in terms of differential and adverse impacts to infants of mothers in population groups of concern, compared to the White population group. Although the regulatory options generate improvements relative to the baseline in terms of avoided IQ point losses, these improvements are small and do not substantially change the differential baseline IQ points among infants of mother who are subsistence and recreational fish consumers. (Table 20).

When evaluating results for the infants of mothers in the subsistence fish consumer cohort under the baseline, a comparison of each population group's share of the cohort's total IQ point losses compared to its share of the cohort's total exposed population shows that Hispanic, Asian (non-Hispanic), American Indian and Alaska Native (non-Hispanic), and Other (non-Hispanic) infants' share of IQ point losses is larger than their share of the exposed population. African American (non-Hispanic) infants' share of IQ point losses is smaller than their share of the exposed population, with 0.6 percent less of a share of the IQ point losses. White infants had a smaller share of IQ point losses compared to their share of the exposed population, with 7.8 percent less of a share of the IQ point losses. The results for infants of mothers in the recreational fish consumer cohort under the baseline shows that, for each population group of concern, infants' share of IQ point losses is larger than their share of the exposed population. White infants' share of IQ point losses is smaller than their share of the exposed population by 5.7 percent.

Examining the impact of the regulatory options on avoided IQ point losses among infants in the various racial and ethnic population groups showed that for both infants of mothers in the subsistence and recreational fish consumer cohorts, all of the regulatory options result in avoided IQ point losses, compared to the baseline, across the racial/ethnic groups, with Option C resulting in the largest combined avoided IQ point losses. Across all regulatory options, for infants of mothers who are subsistence consumers, all people of color experiencing disparities under the baseline receive a share of avoided IQ point losses that is greater than their share of the exposed population, except for Hispanic infants. Additionally, for infants of mothers who are child recreational consumers, only American Indian or Alaska Native (non-Hispanic) infants and Other (non-Hispanic) infants receive a share of avoided IQ point losses that is greater than their share of the exposed population across all regulatory options. For infants of color that experience improvements under the regulatory options in terms of avoided IQ point losses, these improvements are small and do not substantially change the differential baseline IQ points observed among infants under the baseline. Table 21 presents the total IQ points under the baseline and change in avoided IQ point losses under each of the regulatory options for infants of mothers who are subsistence and recreational fish consumers, by income group (below the poverty line or not below the poverty line).

Table 21. Modeled Total IQ Point Losses Under the Baseline and Avoided IQ Point Losses under the Regulatory Options Among Infants of Subsistence and Recreational Fish Consumers Exposed to Mercury *in Utero*, by Income Group

Cohort Group	Income Group	Exposed Population[a]	Baseline Total IQ Point Losses[b]	Option A	Option B	Option C
Child Subsistence	Below the Poverty Line	1,891 (14.6%)	13,925 (14.8%)	34 (16.9%)	39 (16.9%)	39 (16.9%)
	Not Below the Poverty Line	11,070 (85.4%)	80,094 (85.2%)	166 (83.1%)	192 (83.1%)	194 (83.1%)
Child Recreation	Below the Poverty Line	27,565 (14.6%)	68,967 (14.8%)	167 (16.9%)	194 (16.9%)	196 (16.9%)

Table 21. Modeled Total IQ Point Losses Under the Baseline and Avoided IQ Point Losses under the Regulatory Options Among Infants of Subsistence and Recreational Fish Consumers Exposed to Mercury *in Utero*, by Income Group

Cohort Group	Income Group	Exposed Population[a]	Baseline Total IQ Point Losses[b]	Option A	Option B	Option C
	Not Below the Poverty Line	161,324 (85.4%)	395,565 (85.2%)	823 (83.1%)	953 (83.1%)	964 (83.1%)

Source: U.S. EPA analysis, 2024.

Notes:

The exposed population for each income group is presented as the number of infants exposed and (in parenthesis) the number of infants exposed as a share of the total exposed population for the entire cohort.

The baseline total IQ points for each income group are presented as the total number of IQ points and (in parenthesis) the total number of IQ points as a share of the total number of IQ points for the entire cohort.

The results of the distributional analysis of neurological and cognitive health impacts among both infants of mothers who are subsistence and recreational fish consumers indicate potential EJ concerns under the baseline in terms of differential and adverse impacts to infants below the poverty line compared to those not below the poverty line. Although the regulatory options generate improvements relative to the baseline in terms of avoided IQ point losses, these improvements are small and do not substantially change the differential baseline exposures among infants of mother who are subsistence and recreational fish consumers.(Table 21).

The results for the infants of mothers in the subsistence and recreational fish consumer cohorts under the baseline show that infants below the poverty line have a larger share of IQ point losses compared to their share of the exposed population, while infants not below the poverty line have a smaller share of IQ point losses compared to their share of the exposed population by 0.2 and 0.3 percent, respectively (Table 21).

Examining the impact of the regulatory options on avoided IQ point losses by income group shows that for both infants of mothers in the subsistence and recreational fish consumers cohorts, all of the regulatory options result in avoided IQ point losses for both infants below the poverty line and infants not below the poverty line, compared to the baseline (Table 21). Additionally, while under each of the regulatory options infants not below the poverty line had the greatest avoided IQ point losses in absolute terms, the regulatory options resulted in a slightly larger share of IQ point losses avoided for infants below the poverty line, compared to the baseline (Table 21). Of the regulatory options, Option C resulted in the largest combined avoided IQ point losses among infants, compared to the baseline (Table 21). For infants below the poverty line that experience improvements under the regulatory options in terms of avoided IQ point losses, these improvements are small and do not substantially change the differential baseline IQ points observed among infants under the baseline.

4.3.2.4 Distribution of Health Impacts Among Adults Exposed to Arsenic Through Fish Consumption

As detailed in the BCA, the changes in the annual number of skin cancer cases associated with consumption of fish contaminated with arsenic from steam electric power plant discharges are negligible (see Section 5.6 in U.S. EPA, 2024a). Therefore, EPA excluded the distributional analysis of the annual changes in skin cancer cases because the resulting impacts would be reported as very small fractions of cases, which EPA concluded would not be informative. However, EPA expects adults of color, low-income adults, and Indigenous adults to receive shares of the reduced skin cancer cases benefits proportional to their exposure.

4.3.2.5 Key Findings

The results of EPA's analysis of human health impacts resulting from exposures among fish consumers to lead, mercury, and arsenic in downstream surface waters produced informative distributional results only for the analysis of IQ point losses under the baseline and changes in avoided IQ point losses under the regulatory options for infants exposed to mercury *in utero* through maternal recreational and subsistence fish consumption. This analysis showed potential EJ concerns in the baseline in terms of differential, and potentially disproportionate, and adverse impacts to infants of color and infants below the poverty line relative to White infants and infants not below the poverty line, respectively. For infants of mothers in both cohorts, under all of the regulatory options, increases in avoided IQ point losses were estimated relative to the baseline across all racial or ethnic groups and income groups, with Option C generating the greatest combined increases in avoided IQ point losses. Despite these estimated increases in avoided IQ point losses for infants, the improvements EPA estimated under the regulatory options are small and do not substantially change the differential baseline IQ points observed among infants under the baseline. Although distributional analyses were not performed, for all human health endpoints related to lead and arsenic exposures from fish consumption, across population groups of concern and fish consumers, EPA expects low-income and Indigenous children and adults, as well as children and adults of color to receive shares of reduced adverse health impact benefits proportional to their exposure under all the regulatory options.

4.4 Drinking Water

Along with the pollutants evaluated in the surface water analysis, EPA also analyzed changes in bromide loadings from steam electric power plant discharges of FGD wastewater and BA transport water. The presence of bromide in surface water is not considered to pose a risk to human health as the bromide ion has a low degree of toxicity, but as surface waters transport bromide discharges downstream to drinking water treatment facility intakes, bromide can be drawn into the treatment systems and undergo chemical changes that can potentially pose risks to human health through drinking water.[41,42] Of particular concern to EPA is bromide's contribution to the formation of brominated disinfection byproducts (DBPs) during disinfection processes that occur as part of standard drinking water treatment. When surface water containing bromide is disinfected using chlorine a chemical change occurs which produces hypobromite (BrO^-) which reacts with organic matter in the water to produce brominated and mixed chloro-bromo

[41] Halogens discharged by steam electric plants include both bromide and iodine, but EPA quantified only effects associated with brominated DBPs. *In vitro* toxicology studies with bacteria and mammalian cells have documented evidence of genotoxic (including mutagenic), cytotoxic, tumorigenic, and developmental toxicity properties of iodinated DBPs, but the available data are insufficient at this time to determine the extent of iodinated DBP's contribution to adverse human health effects from exposure to treated drinking water.

[42] EPA acknowledges that other pollutants discharged by steam electric power plants to surface waters (*e.g.,* lead, mercury, and arsenic) may affect the quality of water used for public drinking water systems. The pollutants may not be removed adequately during treatment at a drinking water treatment plant and people may then be exposed to such harmful pollutants through ingestion, as well as inhalation and dermal absorption (*e.g.,* showering, bathing). Public drinking water supplies are subject to legally enforceable MCLs, which specify the highest level of a pollutant that is allowed in drinking water, established by EPA. The MCL is based on the MCL Goal (MCLG), which is the level of a contaminant in drinking water below which there is no known or expected risk to human health. EPA sets the MCL as close to the MCLG as possible, with consideration for the best available treatment technologies and costs. In analyzing the human health benefits of the regulatory options, EPA assumes that treated water meets applicable MCLs in the baseline. To assess potential for changes in health risk from exposure to arsenic, lead, and thallium in drinking water, EPA estimated changes in pollutant levels in source waters downstream from steam electric power plants under each regulatory option. The results of this analysis are presented in Section 4.3.2.3 of the BCA (U.S. Environmental Protection Agency. (2024a). *Benefit and Cost Analysis for Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*. (821-R-24-006).). Additionally, a distributional analysis using these results is presented in Section 9.2.

DBPs, including total trihalomethanes (referred to as TTHM). There is evidence that exposure to TTHM through drinking water is linked to the incidence of bladder cancer. For more information on bromide loadings from steam electric power plants, the formation of brominated and mixed chloro-bromo DBPs, and associated human health impacts see Section 4 of the BCA (U.S. EPA, 2024a).

Based on this understanding of potential human health risks related to exposure to TTHM through drinking water, EPA evaluated the distribution of TTHM under the regulatory options in communities served by drinking water systems identified as intaking water directly or indirectly (*i.e.,* purchasing water from a system that intakes directly) from surface waters affected by bromide discharges from steam electric power plants. Additionally, EPA analyzed the distribution of health impacts, specifically incidence of bladder cancer, under the regulatory options in these communities. These analyses were performed to determine whether potential EJ concerns related to exposures to TTHM and bladder cancer incidence exist under the regulatory options. The following sections discuss the results of these analyses.

4.4.1 Distribution of TTHM Exposures Among Affected Communities

To evaluate the distribution of TTHM exposures among communities served by drinking water systems, EPA first estimated bromide concentrations in downstream surface waters identified as receiving FGD wastewater and BA transport water discharges from steam electric power plants under the baseline and regulatory options using the D-FATE model. Regulatory options A and B are estimated to result in the same bromide loading reductions, whereas bromide loading reductions are slightly higher under Option C.

EPA then used information from the SDWIS dataset to determine what PWS downstream of the steam electric power plants would be affected based on whether they directly or indirectly intake source water from an identified downstream surface water receiving bromide discharges from a plant. Combining PWS information from SDWIS with reach-level bromide concentrations modeled in D-FATE, EPA calculated system-level changes in bromide concentrations in the source waters under each of the regulatory options. Using research estimating changes in TTHM levels as a function of changes in bromide levels, EPA used the system-level changes in bromide concentrations under each of the regulatory options to estimate TTHM concentration changes. Finally, EPA estimated population exposures to changes in TTHM concentrations using information on the service area of each system. For a more detailed discussion of EPA methodology for estimating TTHM exposures, see Section 4 of the BCA (U.S. EPA, 2024a).

Table 22 presents the results of this analysis. As noted above, bromide loading changes are the same for regulatory options A and B and therefore the results for these two options are the same. Given the number of systems that EPA identified as being potentially affected by bromide discharges, changes in TTHM concentrations are presented at the state level. EPA calculated the state-level changes in TTHM concentrations presented in Table 22 by weighting the modeled changes in TTHM concentrations under each of the regulatory options across all affected PWSs in each state based on the population served. Table 22 is divided into two sections, states with affected PWSs that have estimated non-zero changes in TTHM concentrations under the regulatory options and states with affected PWSs that have no estimated changes in TTHM concentration under the regulatory options. For states with non-zero changes in TTHM concentrations, the results are presented from greatest to least based on the change calculated for Option C. Information on changes in TTHM concentrations under each of the regulatory options is combined with information on socioeconomic characteristics of the population served in each state by affected PWSs collected from the U.S. Census Bureau’s 2017 to 2021 ACS dataset to assess distributional impacts.

Table 22. Modeled Changes in TTHM Concentrations Under the Regulatory Options Among Potentially Affected Drinking Water Systems, by State

State	# Potentially Affected PWS	Population Served	Percent Low-Income[a]	Percent African-American[a]	Percent Asian [a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent American Indian / Alaska Native [a]	Percent Other [a]	Percent Hispanic/ Latino[a]	Option A and Option B		Option C	
										ΔTTHM (µg/L)[b]	PWS (#)	ΔTTHM (µg/L)[b]	PWS (#)
States with Estimated Changes in TTHM Concentrations													
KS	21	781,859	9.2%	5.0%	4.6%	0.0%	0.6%	3.7%	7.8%	-0.959	21	-0.959	21
ND	13	33,722	8.1%	1.0%	0.8%	0.1%	3.2%	1.8%	3.4%	-0.734	11	-0.734	11
SD	45	43,674	14.6%	1.5%	1.9%	0.0%	19.6%	2.0%	3.2%	-0.709	44	-0.709	44
AL	51	1,243,009	14.4%	21.2%	1.3%	0.0%	0.4%	3.2%	6.4%	-0.701	26	-0.701	26
IN	4	192,275	15.7%	10.5%	1.4%	0.2%	0.0%	3.3%	2.9%	-0.641	4	-0.641	4
NE	13	569,432	15.3%	15.4%	4.4%	0.0%	0.5%	4.2%	12.5%	-0.521	13	-0.521	13
KY	54	1,774,744	16.9%	16.2%	2.1%	0.0%	0.1%	3.5%	4.9%	-0.325	27	-0.325	27
IA	12	155,987	13.9%	3.6%	1.0%	0.3%	0.2%	2.8%	9.6%	-0.252	10	-0.252	10
MO	52	2,658,501	9.3%	17.4%	6.0%	0.1%	0.2%	3.5%	5.1%	-0.248	48	-0.248	48
OH	30	1,229,857	17.9%	22.3%	2.0%	0.0%	0.0%	3.8%	3.9%	-0.161	30	-0.161	30
WV	24	289,810	20.0%	4.6%	1.8%	0.0%	0.1%	3.8%	2.1%	-0.134	24	-0.134	24
IL	86	759,693	13.4%	17.8%	1.4%	0.0%	0.1%	3.7%	4.4%	-0.092	33	-0.092	33
GA	16	706,206	18.0%	31.0%	1.9%	0.1%	0.1%	3.2%	11.5%	-0.081	5	-0.081	5
NC	38	1,514,192	10.8%	27.9%	5.4%	0.0%	0.2%	3.4%	11.9%	-0.020	38	-0.072	38
VA	23	828,925	11.0%	26.5%	5.3%	0.1%	0.2%	5.0%	8.2%	-0.050	23	-0.061	23
PA	93	4,033,477	10.3%	11.7%	4.1%	0.0%	0.1%	3.4%	4.7%	-0.059	41	-0.059	41
SC	72	1,496,142	14.6%	27.7%	1.9%	0.2%	0.2%	3.1%	6.1%	0.000	34	-0.016	34
MA	12	397,487	11.5%	3.9%	9.7%	0.0%	0.1%	2.7%	26.3%	-0.003	12	-0.003	12
MN	11	1,055,600	14.8%	15.7%	10.4%	0.0%	0.7%	5.1%	8.9%	-0.002	11	-0.002	11
States with No Estimated Changes in TTHM Concentrations													
AR	18	20,567	16.5%	0.4%	0.2%	0.1%	1.9%	3.3%	2.7%	0.000	0	0.000	0
DE	1	231,114	12.0%	24.8%	5.2%	0.0%	0.1%	3.4%	11.9%	0.000	0	0.000	0
FL	7	429,167	9.5%	5.6%	1.8%	0.0%	0.2%	2.3%	10.6%	0.000	0	0.000	0
LA	4	89,699	17.5%	25.8%	2.0%	0.0%	0.4%	3.0%	7.8%	0.000	0	0.000	0
MD	20	2,140,060	16.8%	47.9%	4.5%	0.0%	0.2%	3.8%	6.4%	0.000	10	0.000	10
MI	99	3,426,543	17.0%	28.5%	4.6%	0.0%	0.2%	3.6%	5.5%	0.000	0	0.000	0

Table 22. Modeled Changes in TTHM Concentrations Under the Regulatory Options Among Potentially Affected Drinking Water Systems, by State

State	# Potentially Affected PWS	Population Served	Percent Low-Income[a]	Percent African-American[a]	Percent Asian [a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent American Indian / Alaska Native [a]	Percent Other [a]	Percent Hispanic/ Latino[a]	Option A and Option B		Option C	
										ΔTTHM (µg/L)[b]	PWS (#)	ΔTTHM (µg/L)[b]	PWS (#)
MS	2	1,490	19.4%	27.8%	2.7%	0.0%	0.0%	3.3%	8.2%	0.000	0	0.000	0
NH	3	103,592	7.1%	1.6%	3.6%	0.0%	0.1%	3.1%	10.7%	0.000	0	0.000	0
OK	48	828,052	13.6%	8.8%	3.2%	0.1%	6.8%	8.3%	12.1%	0.000	26	0.000	26
TN	43	2,116,969	11.4%	14.5%	2.8%	0.1%	0.1%	3.7%	7.2%	0.000	30	0.000	30
TX	1	23,170	14.6%	5.6%	5.8%	0.0%	0.1%	2.3%	16.0%	0.000	0	0.000	0
Total	916	29,175,015									521		521
US			**12.9%**	**12.1%**	**5.6%**	**0.2%**	**0.6%**	**3.5%**	**19.2%**				

Source: U.S. EPA analysis, 2024.

Notes:

a. Socioeconomic characteristics are population-weighted to reflect differences in populations served by potentially affected PWS within each state, as well as characteristics of different CBGs intersected by the PWS service areas. Each racial and ethnic category besides Hispanic or Latino represent the subset of the race and ethnicity that is identified as “non-Hispanic”.

b. This column shows the average change in TTHM concentrations (in ug/L) under each of the regulatory options across PWS in each state. The change in TTHM concentration was weighted by the populations of the potentially affected PWS in each state.

EPA's analysis shows that, across all states and affected systems, all three regulatory options are estimated to reduce the concentration of TTHM in drinking water, with Option C generating the greatest combined reductions (Table 22). As shown in Table 22, under all regulatory options, reductions in TTHM concentrations are estimated for 521 systems in 19 states, with a median change in TTHM concentration of -0.06 µg/L (Table 22). Of these 19 states, 18 have populations served by affected systems where the percent of the population for at least one population group of concern is above the national average. Within these 18 states, the majority (approximately 75 percent) are states with two or more population groups of concern above the national average. This is similar to the nine states with at least one population group of concern above the national average and with affected PWSs that have no estimated changes in TTHM concentrations under the regulatory options, with the majority (approximately 85 percent) of states having two or more population groups of concern above the national average. For the four states which have one population group of concern above the national average, the median change in TTHM concentrations observed under Option A and Option B is -0.59µg/L and under Option C the change is -0.60µg/L. Across eleven states which have two population groups of concern above the national average, the median change in TTHM concentrations observed under all regulatory options is -0.23µg/L. Lastly, for six states with three or more population groups of concern above the national average, the median change in TTHM concentrations observed under all regulatory options is -0.13µg/L.

4.4.2 Distribution of Bladder Cancer Cases and Deaths Among Affected Communities

To model the relationship between estimated changes in lifetime TTHM exposures and bladder cancer cases, EPA used a life table approach which estimates age-specific changes in bladder cancer probability and models subsequent bladder cancer mortality. The life table approach enables quantification of complex regulatory scenarios that involve variable pollutant changes over time. For this analysis, EPA assumed that the population affected by estimated changes in bromide discharges from steam electric power plants is exposed to baseline TTHM concentrations before implementation of the revised ELGs (before 2025) and to alternative TTHM concentrations from 2025–2049 to be consistent with the framework for evaluating costs and benefits. Therefore, EPA modeled changes in bladder cancer health outcomes resulting from changes in TTHM exposures from 2025-2049. Recognizing that changes in cancer incidence can occur long after exposure, associated changes in bladder cancer incidence were modeled through 2125, though for only the changes attributable to changes in TTHM exposure estimated in the 2025-2049 timeframe. Using available data on bladder cancer incidence and mortality and modeled relationships between changes in TTHM concentrations and changes in lifetime bladder cancer risk, EPA calculated changes in bladder cancer incidence and mortality under the regulatory options. For a more detailed discussion of EPA's methodology for estimating bladder cancer incidence and mortality, see Section 4 of the BCA (U.S. EPA, 2024a).

Table 23 and Table 24 present the results of this analysis by summarizing the distribution of avoided cancer cases and avoided cancer deaths, respectively. Given the number of systems that EPA identified as being potentially affected by changes in bromide discharges, changes in bladder cancer incidence and mortality are presented at the state level. Table 23 and Table 24 are divided into two sections, states with affected PWSs that have estimated non-zero changes in total bladder cancer cases avoided or total excess bladder cancer deaths avoided under the regulatory options and states with affected PWSs that have no estimated changes in total bladder cancer cases avoided or total excess bladder cancer deaths avoided under the regulatory options. For states with non-zero changes in total bladder cancer cases avoided or total excess bladder cancer deaths avoided, the results are presented from greatest to least based on the change calculated for Option C. Similar to the analysis of changes in TTHM concentrations in Table 22, EPA combined information on changes in bladder cancer incidence and mortality under each of the regulatory options with information on socioeconomic characteristics of the exposed populations collected from the U.S. Census Bureau's 2017 to 2021 ACS dataset to assess distributional impacts.

Table 23. Modeled Changes in Total Bladder Cancer Cases Avoided Under the Regulatory Options Among Potentially Affected Drinking Water Systems, by State

State	# Potentially Affected PWS	Population Served	Percent Low-Income [a]	Percent African-American [a]	Percent Asian[a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent American Indian/ Alaska Native[a]	Percent Other[a]	Percent Hispanic/ Latino[a]	Option A and Option B		Option C	
										Cases Avoided (#)[b]	PWS (#)	Cases Avoided (#)[b]	PWS (#)
States with Estimated Changes in Total Bladder Cancer Cases Avoided													
AL	51	1,243,009	14.4%	21.2%	1.3%	0.0%	0.4%	3.2%	6.4%	20.6	20	20.6	20
KS	21	781,859	9.2%	5.0%	4.6%	0.0%	0.6%	3.7%	7.8%	17.8	21	17.8	21
MO	52	2,658,501	9.3%	17.4%	6.0%	0.1%	0.2%	3.5%	5.1%	15.8	48	15.8	48
KY	54	1,774,744	16.9%	16.2%	2.1%	0.0%	0.1%	3.5%	4.9%	14.7	27	14.7	27
NE	13	569,432	15.3%	15.4%	4.4%	0.0%	0.5%	4.2%	12.5%	7.2	13	7.2	13
NC	38	1,514,192	10.8%	27.9%	5.4%	0.0%	0.2%	3.4%	11.9%	0.9	38	5.8	38
PA	93	4,033,477	10.3%	11.7%	4.1%	0.0%	0.1%	3.4%	4.7%	5.0	36	5.0	36
OH	30	1,229,857	17.9%	22.3%	2.0%	0.0%	0.0%	3.8%	3.9%	4.9	30	4.9	30
IN	4	192,275	15.7%	10.5%	1.4%	0.2%	0.0%	3.3%	2.9%	3.1	4	3.1	4
IL	86	759,693	13.4%	17.8%	1.4%	0.0%	0.1%	3.7%	4.4%	1.6	33	1.6	33
VA	23	828,925	11.0%	26.5%	5.3%	0.1%	0.2%	5.0%	8.2%	1.2	23	1.5	23
GA	16	706,206	18.0%	31.0%	1.9%	0.1%	0.1%	3.2%	11.5%	1.4	2	1.4	2
SC	72	1,496,142	14.6%	27.7%	1.9%	0.2%	0.2%	3.1%	6.1%	0.0	32	1.3	32
IA	12	155,987	13.9%	3.6%	1.0%	0.3%	0.2%	2.8%	9.6%	0.9	10	0.9	10
WV	24	289,810	20.0%	4.6%	1.8%	0.0%	0.1%	3.8%	2.1%	0.9	24	0.9	24
ND	13	33,722	8.1%	1.0%	0.8%	0.1%	3.2%	1.8%	3.4%	0.6	11	0.6	11
SD	45	43,674	14.6%	1.5%	1.9%	0.0%	19.6%	2.0%	3.2%	0.6	43	0.6	43
MN	11	1,055,600	14.8%	15.7%	10.4%	0.0%	0.7%	5.1%	8.9%	0.1	11	0.1	11
States with No Estimated Changes in Total Bladder Cancer Cases Avoided													
AR	18	20,567	16.5%	0.4%	0.2%	0.1%	1.9%	3.3%	2.7%	0.0	0	0.0	0
DE	1	231,114	12.0%	24.8%	5.2%	0.0%	0.1%	3.4%	11.9%	0.0	0	0.0	0
FL	7	429,167	9.5%	5.6%	1.8%	0.0%	0.2%	2.3%	10.6%	0.0	0	0.0	0
LA	4	89,699	17.5%	25.8%	2.0%	0.0%	0.4%	3.0%	7.8%	0.0	0	0.0	0
MA	12	397,487	11.5%	3.9%	9.7%	0.0%	0.1%	2.7%	26.3%	0.0	12	0.0	12
MD	20	2,140,060	16.8%	47.9%	4.5%	0.0%	0.2%	3.8%	6.4%	0.0	5	0.0	5
MI	99	3,426,543	17.0%	28.5%	4.6%	0.0%	0.2%	3.6%	5.5%	0.0	0	0.0	0

Table 23. Modeled Changes in Total Bladder Cancer Cases Avoided Under the Regulatory Options Among Potentially Affected Drinking Water Systems, by State

State	# Potentially Affected PWS	Population Served	Percent Low-Income [a]	Percent African-American [a]	Percent Asian[a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent American Indian/ Alaska Native[a]	Percent Other[a]	Percent Hispanic/ Latino[a]	Option A and Option B		Option C	
										Cases Avoided (#)[b]	PWS (#)	Cases Avoided (#)[b]	PWS (#)
MS	2	1,490	19.4%	27.8%	2.7%	0.0%	0.0%	3.3%	8.2%	0.0	0	0.0	0
NH	3	103,592	7.1%	1.6%	3.6%	0.0%	0.1%	3.1%	10.7%	0.0	0	0.0	0
OK	48	828,052	13.6%	8.8%	3.2%	0.1%	6.8%	8.3%	12.1%	0.0	25	0.0	25
TN	43	2,116,969	11.4%	14.5%	2.8%	0.1%	0.1%	3.7%	7.2%	0.0	28	0.0	28
TX	1	23,170	14.6%	5.6%	5.8%	0.0%	0.1%	2.3%	16.0%	0.0	0	0.0	0
Total	916	29,175,015								97.4	496	103.8	496
Total	916	29,175,015								97.4	496	103.8	496
US			12.9%	12.1%	5.6%	0.2%	0.6%	3.5%	19.2%				

Source: U.S. EPA analysis, 2024.

Notes:

a. Socioeconomic characteristics are population-weighted to reflect differences in populations served by potentially affected PWS within each state, as well as characteristics of different CBGs intersected by the PWS service areas. Each racial and ethnic category besides Hispanic or Latino represent the subset of the race and ethnicity that is identified as "non-Hispanic".

b. This column shows the total number of bladder cancer cases avoided under each of the regulatory options over the period of analysis.

Table 24. Modeled Changes in Total Excess Bladder Cancer Deaths Avoided Under the Regulatory Options Among Potentially Affected Drinking Water Systems, by State

State	# Potentially Affected PWS	Population Served	Percent Low-Income[a]	Percent African-American[a]	Percent Asian[a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent American Indian/ Alaska Native[a]	Percent Other[a]	Percent Hispanic/ Latino[a]	Option A and Option B		Option C	
										Deaths Avoided (#)[b]	PWS (#)	Deaths Avoided (#)[b]	PWS (#)
States with Changes in Total Excess Bladder Cancer Deaths Avoided													
AL	51	1,243,009	14.4%	21.2%	1.3%	0.0%	0.4%	3.2%	6.4%	5.8	20	5.8	20
KS	21	781,859	9.2%	5.0%	4.6%	0.0%	0.6%	3.7%	7.8%	5.0	21	5.0	21
MO	52	2,658,501	9.3%	17.4%	6.0%	0.1%	0.2%	3.5%	5.1%	4.4	48	4.4	48
KY	54	1,774,744	16.9%	16.2%	2.1%	0.0%	0.1%	3.5%	4.9%	4.2	27	4.2	27
NE	13	569,432	15.3%	15.4%	4.4%	0.0%	0.5%	4.2%	12.5%	2.0	13	2.0	13
NC	38	1,514,192	10.8%	27.9%	5.4%	0.0%	0.2%	3.4%	11.9%	0.3	38	1.7	38
OH	30	1,229,857	17.9%	22.3%	2.0%	0.0%	0.0%	3.8%	3.9%	1.4	30	1.4	30
PA	93	4,033,477	10.3%	11.7%	4.1%	0.0%	0.1%	3.4%	4.7%	1.4	36	1.4	36
IN	4	192,275	15.7%	10.5%	1.4%	0.2%	0.0%	3.3%	2.9%	0.9	4	0.9	4
IL	86	759,693	13.4%	17.8%	1.4%	0.0%	0.1%	3.7%	4.4%	0.5	33	0.5	33
GA	16	706,206	18.0%	31.0%	1.9%	0.1%	0.1%	3.2%	11.5%	0.4	2	0.4	2
SC	72	1,496,142	14.6%	27.7%	1.9%	0.2%	0.2%	3.1%	6.1%	0.0	32	0.4	32
VA	23	828,925	11.0%	26.5%	5.3%	0.1%	0.2%	5.0%	8.2%	0.3	23	0.4	23
IA	12	155,987	13.9%	3.6%	1.0%	0.3%	0.2%	2.8%	9.6%	0.3	10	0.3	10
WV	24	289,810	20.0%	4.6%	1.8%	0.0%	0.1%	3.8%	2.1%	0.3	24	0.3	24
ND	13	33,722	8.1%	1.0%	0.8%	0.1%	3.2%	1.8%	3.4%	0.2	11	0.2	11
SD	45	43,674	14.6%	1.5%	1.9%	0.0%	19.6%	2.0%	3.2%	0.2	43	0.2	43
States with No Changes in Total Excess Bladder Cancer Deaths Avoided													
AR	18	20,567	16.5%	0.4%	0.2%	0.1%	1.9%	3.3%	2.7%	0.0	0	0.0	0
DE	1	231,114	12.0%	24.8%	5.2%	0.0%	0.1%	3.4%	11.9%	0.0	0	0.0	0
FL	7	429,167	9.5%	5.6%	1.8%	0.0%	0.2%	2.3%	10.6%	0.0	0	0.0	0
LA	4	89,699	17.5%	25.8%	2.0%	0.0%	0.4%	3.0%	7.8%	0.0	0	0.0	0
MA	12	397,487	11.5%	3.9%	9.7%	0.0%	0.1%	2.7%	26.3%	0.0	12	0.0	12
MD	20	2,140,060	16.8%	47.9%	4.5%	0.0%	0.2%	3.8%	6.4%	0.0	5	0.0	5
MI	99	3,426,543	17.0%	28.5%	4.6%	0.0%	0.2%	3.6%	5.5%	0.0	0	0.0	0
MN	11	1,055,600	14.8%	15.7%	10.4%	0.0%	0.7%	5.1%	8.9%	0.0	11	0.0	11

Table 24. Modeled Changes in Total Excess Bladder Cancer Deaths Avoided Under the Regulatory Options Among Potentially Affected Drinking Water Systems, by State

State	# Potentially Affected PWS	Population Served	Percent Low-Income[a]	Percent African-American[a]	Percent Asian[a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent American Indian/ Alaska Native[a]	Percent Other[a]	Percent Hispanic/ Latino[a]	Option A and Option B		Option C	
										Deaths Avoided (#)[b]	PWS (#)	Deaths Avoided (#)[b]	PWS (#)
MS	2	1,490	19.4%	27.8%	2.7%	0.0%	0.0%	3.3%	8.2%	0.0	0	0.0	0
NH	3	103,592	7.1%	1.6%	3.6%	0.0%	0.1%	3.1%	10.7%	0.0	0	0.0	0
OK	48	828,052	13.6%	8.8%	3.2%	0.1%	6.8%	8.3%	12.1%	0.0	25	0.0	25
TN	43	2,116,969	11.4%	14.5%	2.8%	0.1%	0.1%	3.7%	7.2%	0.0	28	0.0	28
TX	1	23,170	14.6%	5.6%	5.8%	0.0%	0.1%	2.3%	16.0%	0.0	0	0.0	0
Total	916	29,175,015								27.5	496	29.3	496
US			12.9%	12.1%	5.6%	0.2%	0.6%	3.5%	19.2%				

Source: U.S. EPA analysis, 2024.

Notes:

a. Socioeconomic characteristics are population-weighted to reflect differences in populations served by potentially affected PWS within each state, as well as characteristics of different CBGs intersected by the PWS service areas. Each racial and ethnic category besides Hispanic or Latino represent the subset of the race and ethnicity that is identified as "non-Hispanic".

b. This column shows the total number of excess bladder cancer deaths avoided under each of the regulatory options over the period of analysis.

EPA's analysis shows that all three regulatory options result in avoided bladder cancer cases over the period of analysis (Table 23). Under all options, EPA estimates avoided bladder cancer cases in 18 states across 496 PWS, with a median change of 0.75 cases avoided under Option C. Option A or Option B result in a total of 97 cases avoided, while Option C results in 104 cases avoided. Of the 18 states with avoided bladder cancer cases, 17 have populations served by affected systems where the percent of the population for at least one population group of concern is above the national average. Within these 17 states, the majority (approximately 75 percent) are states with two or more population groups of concern above the national average. This is similar to the 10 states with at least one population group of concern above the national average and no estimated changes in total bladder cancer cases avoided under the regulatory options, with the majority (approximately 90 percent) of state having two or more population groups of concern above the national average.

Based on the results summarized in Table 23, states that have populations served by affected systems where the percent of the population for one population group of concern is above the national average have a median number of avoided bladder cancer cases of about two cases under Option A or Option B and four cases under Option C. States that have populations served by affected systems where the percent of the population for two population groups of concern is above the national average have a median number of avoided bladder cancer cases of about one case under all three options. States that have populations served by affected systems where the percent of the population for three or more population groups of concern is above the national average have a median number of avoided bladder cancer cases of about one case under all regulatory options.

Similarly, EPA's analysis shows that, across all states, all of the regulatory options result in avoided excess bladder cancer deaths (Table 24). Under all regulatory options, EPA estimated avoided bladder cancer deaths in 17 states across 496 PWS, with a median change of 0.25 avoided bladder cancer deaths. Of the 17 states with avoided bladder cancer deaths, 16 have populations served by affected systems where the percent of the population for at least one population group of concern is above the national average. Within these 16 states, the majority (approximately 75 percent) are states with two or more population groups of concern above the national average. This is similar to the 11 states with at least one population group of concern above the national average and no estimated changes in total bladder cancer deaths avoided under the regulatory options, with the majority (approximately 90 percent) of states having two or more population groups of concern above the national average (Table 24).

Based on the results summarized in Table 24, states that have populations served by affected systems where the percent of the population for one population group of concern is above the national average have a median number of avoided excess bladder cancer deaths of about 0.6 deaths under Option A or Option B and 1.3 deaths under Option C. States that have populations served by affected systems where the percent of the population for two population groups of concern is above the national average have a median number of avoided excess bladder cancer deaths of about 0.3 deaths under Option A or Option B and 0.4 deaths under Option C. States that have populations served by affected systems where the percent of the population for three or more population groups of concern is above the national average have a median number of avoided excess bladder cancer deaths of about 0.2 deaths under all regulatory options.

4.4.3 Key Findings

The results of EPA's analysis of changes in TTHM concentrations and resulting changes in bladder cancer cases and deaths from consuming drinking water with TTHM, shows that all three regulatory options reduce TTHM concentrations and reduce the incidence of bladder cancer cases and excess bladder cancer deaths in states with affected drinking water systems. Of the regulatory options evaluated, across the analyses and states with affected systems, Option C results in the greatest improvements. Across the analyses, under each of the regulatory options, the majority of states with affected systems serve populations with at least one population group of concern above the national average, with the largest proportion of these states having two or more population groups of concern above the national average. Analyzing the distribution of changes across the analyses and regulatory options, EPA finds that states with affected systems serving populations with one population group of concern above the national average experience the largest median changes in TTHM concentrations and avoided bladder cancer cases and excess bladder cancer deaths than states serving populations with two and three or more population groups of concern above the national average, respectively. Despite this, the median changes in states with one, two, or three or more population groups of concern above the national average is greater than median change estimated across all states for each of the analyses. While the magnitude of the median change observed across the analyses decrease in communities with one, two, or three or more population groups of concern above the national average, EPA finds that this is not due to there being smaller reductions in TTHM concentrations and avoided bladder cancer cases and excess bladder cancer deaths, but rather that these states generally have more systems experiencing smaller changes. Given that the analysis focused on changes under the regulatory options, EPA is not able to draw conclusions with respect to how the regulatory options contribute to addressing any differential, and potentially disproportionate, and adverse exposures to TTHM and the incidence of bladder cancer cases and deaths among population groups of concern in the baseline.

4.5 Cumulative Risks

In previous Steam Electric EAs, EPA focused on assessing potential impacts to human health caused by individual pollutants present in steam electric power plant wastewater discharges. As indicated by the results of the human health effects in the immediate receiving water distributional analysis (section 4.2), communities can be exposed to multiple pollutants from steam electric power plant discharges, the effects of which may not be fully captured when analyzing impacts on the basis of an individual pollutant. Therefore, for the proposed rule, EPA expanded the individual pollutant assessment to include a further evaluation of potential impacts to human health from mixtures of pollutants present in steam electric power plant discharges. As shown in the EJA for the proposed rule, EPA only identified a handful of immediate receiving waters with exceedances of pollutant mixture- and human health-specific Hazard Indices (HIs), with changes under the proposed regulatory options that were too small to substantially change baseline distributional disparities. For the final rule, EPA's analysis of cumulative risks produced similar results under the baseline and the regulatory options. Therefore, EPA determined it would not be informative to conduct a distributional analysis of cumulative risks. For more information on the results of EPA's cumulative risk analysis for the final rule, see the 2024 EA and U.S. EPA (2024).

5. Analysis of the Distribution of Benefits and Costs of the Final Rule

In addition to evaluating the distribution of exposures and health impacts, EPA examined the distribution of incremental benefits and costs of the regulatory options. The Office of Management and Budget (OMB) Circular A-4 (2023) defines "distributional effects" as "how the benefits and the costs of a regulatory action are ultimately experienced across the population and economy, divided up in various ways (*e.g.*, income groups, race or ethnicity, sex, gender, sexual orientation, disability, occupation, or geography; or relevant categories for firms, including firm size and industrial sector)." (p. 61) As discussed below, EPA research demonstrates that climate change impacts associated with greenhouse gas (GHG) emissions disparately accrue to minority and low-income populations and expects that the final rule could benefit these populations to a greater degree due to estimate reductions in GHGs under the regulatory options. However, other benefits and costs evaluated under the final rule may not have substantial impacts distributionally.

5.1 Benefits

EPA began its evaluation of the final rule's distributional effects with an assessment of the categories of benefits. For the final rule (Option B), approximately 99 percent of the benefits accrue from reductions in air pollution due to estimated shifts in electric generation resulting from the incremental costs of the final rule on coal steam electricity generating units. Furthermore, these air benefits are comprised of approximately a 3-to-1 ratio of conventional air pollutants health benefits to GHG benefits. Thus, while EPA evaluated a number of exposures and endpoints for differential impacts, as discussed above, for purposes of evaluating the distributional effects of the final rule, the Agency focuses on these two benefit categories for further evaluation.[43]

5.1.1 GHG Benefits

In 2009, under the Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act ("Endangerment Finding"), the Administrator considered how climate change threatens the health and welfare of the U.S. population (U.S. EPA, 2009). As part of that consideration, the Administrator also considered risks to minority and low-income individuals and communities, finding that certain parts of the U.S. population may be especially vulnerable based on their characteristics or circumstances. These groups include economically and socially disadvantaged communities; individuals at vulnerable lifestages, such as the elderly, the very young, and pregnant or nursing women; those already in poor health or with comorbidities; the disabled; those experiencing homelessness, mental illness, or substance abuse; and/or Indigenous or people of color dependent on one or limited resources for subsistence due to factors including but not limited to geography, access, and mobility.

Scientific assessment and agency reports produced over the past decade by the United States Global Change Research Program (USGCRP), the Intergovernmental Panel on Climate Change (IPCC), and the National Academies of Science, Engineering, and Medicine (NASEM) add more evidence that the impacts of climate change raise EJ concerns (IPCC, 2018; National Academies of Sciences, 2017; National Research Council, 2011; Oppenheimer et al., 2014; Porter et al., 2014; Smith et al., 2014; USGCRP, 2016, 2018). These reports conclude that poorer communities or communities of color can be especially vulnerable to climate change impacts because they tend to have limited adaptive capacities and are more dependent on climate-sensitive resources such as local water and food supplies or have less access to social and

[43] EPA acknowledges that while the assessment of benefits under Option B show that nearly all the benefits associated with the final rule can be attributed to benefits from reductions in air pollution, benefits associated with other potential impacts from the rule that EPA did not quantify, like changes in housing prices, could also have distributional impacts across affected populations.

information resources. Some communities of color, specifically populations defined jointly by ethnic or racial characteristics and geographic location, may be uniquely vulnerable to climate change health impacts in the U.S.. In particular, the 2016 scientific assessment on the *Impacts of Climate Change on Human Health* found with high confidence that vulnerabilities are place-and time-specific, lifestages and ages are linked to immediate and future health impacts, and social determinants of health are linked to greater extent and severity of climate change-related health impacts.

5.1.1.1 Effects on Specific Population Groups of Concern

Socioeconomic and educational factors affect the likelihood of an individual being exposed to negative impacts of climate change. Individuals living in socially and economically disadvantaged communities, such as those living at or below the poverty line or those who are experiencing homelessness or social isolation, are at greater risk of health effects from climate change. This is also true with respect to people at vulnerable lifestages, specifically women who are pre-and perinatal, or are nursing; in utero fetuses; children at all stages of development; and the elderly. Per the Fourth National Climate Assessment (NCA4), "Climate change affects human health by altering exposures to heat waves, floods, droughts, and other extreme events; vector-, food-and waterborne infectious diseases; changes in the quality and safety of air, food, and water; and stresses to mental health and well-being" (Ebi et al., 2018). Many health conditions such as cardiovascular or respiratory illness and other health impacts are associated with and exacerbated by an increase in GHGs and climate change outcomes, which is problematic as these diseases occur at higher rates within vulnerable communities. Importantly, negative public health outcomes include those that are physical in nature, as well as mental, emotional, social, and economic.

To this end, as well, the scientific assessment literature–including the aforementioned USGCRP, IPCC, and NASEM reports–demonstrates that there are myriad ways in which these populations may be affected at the individual and community levels. Individuals face differential exposure to criteria pollutants, in part due to the proximity of highways, trains, factories, and other major sources of pollutant-emitting sources to less-affluent residential areas. Outdoor workers, such as construction or utility crews and agricultural laborers, who frequently are comprised of already at-risk groups, are exposed to poor air quality and extreme temperatures without relief. U.S. EPA (2021) projected that individuals who are low-income or who do not have a high school diploma are 25 percent more likely to live in areas with the greatest losses of labor hours due to extreme temperatures. Low-income individuals or those without high school diplomas are 15 percent more likely to live in areas that are projected to see the greatest increases in childhood asthma diagnoses, due to climate change-driven increases to particulate air pollution. Furthermore, individuals within population groups of concern face greater housing, clean water, and food insecurity and bear disproportionate economic impacts and health burdens associated with climate change effects. They have less or limited access to healthcare and affordable, adequate health or homeowner insurance. Finally, resiliency and adaptation are more difficult for economically disadvantaged communities: they have less liquidity, individually and collectively, to move or to make the types of infrastructure or policy changes to limit or reduce the hazards they face. They frequently are less able to self-advocate for resources that would otherwise aid in building resilience and hazard reduction and mitigation. Further findings of U.S. EPA (2021) include findings that the following groups are more likely than their reference population to currently live in areas with:

- The highest increases in childhood asthma diagnoses from climate-driven changes in PM2.5 (low-income, Black and African American, Hispanic and Latino, and Asian populations);
- The highest percentage of land lost to inundation (low-income, American Indian and Alaska Native populations);
- The highest increases in mortality rates due to climate-driven changes in extreme temperatures (low-income and Black and African American populations);
- The highest rates of labor hour losses for weather-exposed workers due to extreme temperatures (low-income, Black and African American, American Indian and Alaska Native, Hispanic and Latino, and Pacific Islander populations);

- The highest increases in traffic delays associated with high-tide flooding (low-income, Hispanic and Latino, Asian, and Pacific Islander populations); and
- The highest damages from inland flooding (Pacific Islander populations).

It is important to examine ways in which socially and physiologically vulnerable groups are exposed to, and experience threats posed by climate change. The assessment literature cited in EPA's 2009 and 2016 Endangerment Findings, as well as *Impacts of Climate Change on Human Health* (USGCRP, 2016), concluded that certain populations and life stages, including children and older individuals, are more vulnerable to climate-related health effects. The assessment literature produced from 2016 to the present strengthens these conclusions by providing more detailed findings regarding related vulnerabilities and the projected impacts youth may experience. These assessments–including the NCA4 Ebi et al., 2018 and *The Impacts of Climate Change on Human Health in the United States* (USGCRP, 2016)–describe how children's unique physiological and developmental factors contribute to making them particularly vulnerable to climate change. Impacts to children are expected from heat waves, air pollution, infectious and waterborne illnesses, and mental health effects resulting from extreme weather events. In addition, children are among those especially susceptible to allergens, as well as health effects associated with heat waves, storms, and floods. Additional health concerns may arise in low-income households, especially those with children, if climate change reduces food availability and increases prices, leading to food insecurity within households.

Present research demonstrates that exposures and vulnerabilities to climate change impacts are a product of a complex set of racial, ethnic, and age demographics; and geographic, sociocultural, and economic factors. Individuals may experience hazards in aggregate or individually; they also may have one, some, or multiple of the vulnerabilities considered. The *Impacts of Climate Change on Human Health* (USGCRP, 2016) found that some people of color, low-income groups, people with limited English proficiency, and certain immigrant groups (especially those who are undocumented) live with many of the factors that contribute to their vulnerability to the health impacts of climate change. While difficult to isolate from related socioeconomic factors, race appears to be an important factor in vulnerability to climate-related stress, with elevated risks for mortality from high temperatures reported for Black or African American individuals compared to White individuals after controlling for factors such as air conditioning use. Some research has found that race or ethnicity alone, more than other individual demographic and socioeconomic characteristics, may play a significant role in determining one's risk of experiencing harm as a result of climate change. This includes estimates that Black Americans are 40 percent more likely than non-Black individuals to live in areas of the U.S. experiencing the highest projected increases in mortality rates due to changes in extreme temperatures (under a scenario of 2°C of global warming). Additionally, Hispanic and Latino individuals in weather-exposed industries were found to be 43 percent more likely to currently live in areas with the highest projected labor hour losses due to extreme temperatures (U.S. EPA, 2021). Moreover, people of color are differentially exposed to air pollution based on where they live, and potentially disproportionately vulnerable due to higher baseline prevalence of underlying diseases such as asthma, so climate exacerbations of air pollution are expected to have potentially disproportionate effects on these communities.

Indeed, Indigenous communities possess unique vulnerabilities to climate change, particularly those impacted by degradation of natural and cultural resources within established reservation boundaries and threats to traditional subsistence lifestyles. Indigenous communities whose health, economic well-being, and cultural traditions depend upon the natural environment will likely be affected by the degradation of ecosystem goods and services associated with climate change. EPA found that American Indian and Alaska Native individuals are 48 percent more likely than individuals not identifying as such to currently live in areas where the highest percentage of land is projected to be inundated due to sea level rise (under a scenario of 50cm of global sea level rise). Asian-Americans are 23 percent more likely to live in coastal areas projected to see the highest increases in traffic delays due to high-tide flooding on roadways (U.S. EPA, 2021). The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5) indicates that losses of customs and historical knowledge may cause communities to be less resilient or adaptable (Porter et al., 2014). The NCA4 noted that while Indigenous peoples are diverse and will be impacted by the climate changes universal to all Americans, there are several ways in which climate change uniquely threatens Indigenous peoples' livelihoods and economies (Jantarasami et al., 2018).

In addition, there can be institutional barriers to their management of water, land, and other natural resources that could impede adaptive measures. For example, Indigenous agriculture in the Southwest is already being adversely affected by changing patterns of flooding, drought, dust storms, and rising temperatures leading to increased soil erosion, irrigation water demand, and decreased crop quality and herd sizes. The Confederated Tribes of the Umatilla Indian Reservation in the Northwest have identified climate risks to salmon, elk, deer, roots, and huckleberry habitat. Housing and sanitary water supply infrastructure are vulnerable to disruption from extreme precipitation events.

The NCA4 noted that Indigenous peoples often have differentially higher rates of asthma, cardiovascular disease, Alzheimer's, diabetes, and obesity, which can all contribute to increased vulnerability to climate-driven extreme heat and air pollution events Jantarasami et al., 2018. These factors also may be exacerbated by stressful situations, such as extreme weather events, wildfires, and other circumstances (Jantarasami et al., 2018).

The NCA4 and IPCC AR5 also highlighted several impacts specific to Alaska Indigenous peoples (Jantarasami et al., 2018; Porter et al., 2014). Coastal erosion and permafrost thaw will lead to more coastal erosion, exacerbated risks of winter travel, and damage to buildings, roads, and other infrastructure–these impacts on archaeological sites, structures, and objects that will lead to a loss of cultural heritage for Alaska's Indigenous people. In terms of food security, the NCA4 discussed reductions in suitable ice conditions for hunting, warmer temperatures impairing the use of traditional ice cellars for food storage, and declining shellfish populations due to warming and acidification Jantarasami et al., 2018. While the NCA4 also noted that climate change provided more opportunity to hunt from boats later in the fall season or earlier in the spring, the assessment found that the net impact was an overall decrease in food security (Jantarasami et al., 2018).

In addition, the U.S. Pacific Islands and the Indigenous communities that live there are also uniquely vulnerable to the effects of climate change due to their remote location and geographic isolation. They rely on the land, ocean, and natural resources for their livelihoods, but face challenges in obtaining energy and food supplies that need to be shipped in at high costs. As a result, they face higher energy costs than the rest of the nation and depend on imported fossil fuels for electricity generation and diesel. These challenges exacerbate the climate impacts that the Pacific Islands are experiencing. The NCA4 notes that Indigenous peoples of the Pacific are threatened by rising sea levels, diminishing freshwater availability, and negative effects to ecosystem services that threaten these individuals' health and well-being (Jantarasami et al., 2018).

EPA notes that the changes in GHGs attributable to the regulatory options are small compared to worldwide emissions. Nevertheless, the overall findings of these above-mentioned peer-reviewed evaluations demonstrate that actions that reduce GHG emissions are likely to reduce impacts on vulnerable communities, including people of color and low-income populations.

5.1.2 Conventional Air Pollutant Health Benefits

The current EPA modeling methodology for conventional air pollutants results in benefits that are proportional to exposures. In other words, the distributional findings of air pollutant exposures discussed above are the same findings EPA has for this benefit category: exposure and health benefit improvements and degradations attributable to this proposal will be proportionately experienced by all demographic populations evaluated. However, there are several important nuances and caveats to this conclusion owing to differences in vulnerability and health outcomes across population subgroups. For example, there is some information suggesting that the same $PM_{2.5}$ exposure reduction will reduce the hazard of mortality more so in Black populations than in White populations (U.S. EPA, 2019b, 2022b). In addition, demographic-stratified information relating $PM_{2.5}$ and ozone to other health effects and valuation estimates is currently lacking.

5.2 Costs

Energy provides many services to households that are necessary for a basic standard of living. The regulatory requirements will obligate steam electric plants to incur costs to install effluent controls, which may impact the supply and prices of electricity, specifically residential electricity. This section discusses how consumers can be affected by potential energy market impacts and characterizes how energy burdens vary across the income and for different racial or ethnic groups. The goal of this section is to highlight which populations may be most vulnerable to potential energy market effects caused by regulatory impacts on the steam electric power sector. In addressing these vulnerabilities, energy poverty, insecurity, and access are important concepts in the discussion of energy burden. Energy insecurity is when households lack certainty that they will be able to afford their energy bills. Energy poverty is when households lack sufficient energy to meet their needs. Finally, energy access barriers are present when households lack access to affordable, reliable energy.

Energy poverty, insecurity, and access barriers are persistent problems facing many households across the United States. Low-income households and households of color are particularly vulnerable when energy prices increase. Although these households consume less energy, it tends to represent a larger share of their budgets. Drehobl, Ross and Ayala (2020) find that low-income, Black, Hispanic, Native American, and older adult households have disproportionally higher energy burdens than the average household. Lyubich (2020) finds that Black households spend more on residential energy than White households after controlling for income, household size, city, and homeowner status. Reames (2016) finds that home heating energy efficiency is lower for census blocks in Kansas City, Missouri with a greater percentage of households in poverty, higher percentage of y heads-of-household of color, lower median incomes, and a higher share of adults without a high school diploma. He attributes the higher fuel poverty vulnerability among Black and Hispanic households to racial segregation.

To investigate potential distributional impacts of higher electricity and fuel prices, EPA collected 2022 expenditure and income data stratified by pre-tax income quintiles and race from the Consumer Expenditure Survey (CES) from the U.S. Bureau of Labor Statistics. EPA combined expenditures in the following four categories to approximate “energy expenditures”: (1) Natural gas, (2) Electricity, (3) Fuel oil and other fuels, and (4) Gasoline, other fuels, and motor oil (transportation). The first three categories are residential energy expenditures, and the fourth category represents transportation energy expenditures. These categories are assumed to potentially experience price impacts due to regulatory costs affecting the steam electric power sector, though EPA expects impacts to be minimal. EPA examines energy expenditures, the ratio of household energy expenditures to total household expenditures, and the ratio of household energy expenditures to after-tax income across income quintiles and racial and ethnic groups. It is important to note that energy burden is sensitive to what energy services and expenditures are included and how income is defined (*e.g.,* whether transfer payments or taxes are included in income calculation).

Table 25. Energy Expenditures by Quintiles of Income before Taxes, 2022

	All	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Average income after taxes	$83,195	$16,337	$39,300	$63,676	$99,891	$196,794
Average annual expenditures	$72,967	$32,612	$47,657	$61,950	$81,957	$140,654
Natural gas	$535	$320	$444	$503	$598	$809
Electricity	$1,683	$1,205	$1,527	$1,664	$1,835	$2,185
Fuel oil and other fuels	$160	$66	$104	$135	$192	$305

Table 25. Energy Expenditures by Quintiles of Income before Taxes, 2022

	All	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Gasoline, other fuels, and motor oil (transportation)	$3,120	$1,553	$2,360	$3,166	$3,919	$4,601
Total expenditures on energy	**$5,498**	**$3,144**	**$4,435**	**$5,468**	**$6,544**	**$7,900**
Energy expenditures as share of total expenditures	7.5%	9.6%	9.3%	8.8%	8.0%	5.6%
Energy expenditures as share of income	6.6%	19.2%	11.3%	8.6%	6.6%	4.0%
Quintile's share of all energy expenditures		11.4%	16.1%	19.9%	23.8%	28.7%

Source: U.S. Bureau of Labor Statistics (2023)

Note: Income includes wages, self-employment income, Social Security and retirement payments, interest, dividends, rental income and other property income, public assistance, unemployment and workers' compensation, veterans' benefits, and regular contributions for support.

The data in Table 25 indicate that the highest income group consumes the most energy and spends the most per household, but energy expenditures represent a smaller percentage of their total expenditures and a smaller percentage of their income than the lowest income quintile. The lowest income quintile accounted for 11.4 percent of energy expenditures, while the highest quintile accounted for almost 29 percent. However, energy expenditures as a share of total household expenditures were 9.6 percent for the lowest income quintile and 5.6 percent for the highest income quintile. For energy expenditures as a share of average after-tax income, the distribution is more unequal, ranging from 19.2 percent for the lowest income quintile to 4.0 percent for the highest income quintile. This means the lowest income households are spending over five times more of their income on energy than the highest income households. The highest income quintile spent about $7,900 per household on energy and had an average after-tax income of $196,000 in 2022 while the lowest income quintile spent about $3,144 per household on energy and had $16,000 of after-tax income. Thus, lower income households consume less energy than higher income households, but their energy expenditures account for a higher share of total household expenditures on average and a higher share of after-tax income compared to higher income households.

Table 26 summarizes average demographics by income quintile. Households in the lowest income quintile are more than twice as likely to be Black than households in the highest income quintile. The higher income groups also tend to be less likely to be Hispanic than the lower income groups.

Table 26. Demographics by Quintiles of Income before Taxes, 2022

	All	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Black	13%	17%	15%	13%	11%	9%
White, Asian, and all other races	87%	83%	85%	87%	89%	91%
Hispanic or Latino	15%	16%	17%	17%	14%	10%
Not Hispanic or Latino	85%	84%	83%	83%	86%	90%

Source: U.S. Bureau of Labor Statistics (2023)

Table 27 and Table 28 show household energy expenditures by race and ethnicity. Black households' energy expenditures represent a higher share of their total expenditures than for households of other races, although their energy expenditures are lower. Hispanic households' energy expenditures comprise a larger share of their total expenditures than non-Hispanic households, although they spend slightly more per household on energy than non-Hispanic households. For Black households, energy expenditures were about $3,700 in 2019 and accounted for about 8 percent of total expenditures and 7 percent of after-tax income. For White and other non-Black households, energy expenditures accounted for about 6.4 percent of total expenditures and 5.7 percent of after-tax income, though they spent more on energy ($4,200 per household). For Hispanic households, energy expenditures were about $4,200 in 2019 and accounted for about 8 percent of total expenditures and 7 percent of after-tax income. These numbers are higher than for non-Hispanic households, whose energy expenditures accounted for about 6.3 percent of total expenditures and 5.6 percent of after-tax income, although non-Hispanic households spent less on energy per household at $4,100.

Table 27. Energy Expenditures by Race, 2022

	All Consumer Units	White, Asian, and All other Races	White and All other Races (not Asian)	Asian	Black
Number of consumer units (thousands)	132,242	114,554	108,246	6,308	17,688
Income before taxes	$82,852	$86,743	$85,417	$109,492	$57,649
Income after taxes	$71,487	$74,436	$73,341	$93,221	$52,389
Average annual expenditures	$63,036	$65,446	$64,981	$73,433	$47,230
Natural gas	$416	$417	$413	$481	$409
Electricity	$1,472	$1,479	$1,496	$1,192	$1,424
Fuel oil and other fuels	$113	$123	$127	$42	$52
Gasoline, other fuels, and motor oil (transportation)	$2,094	$2,141	$2,146	$2,042	$1,794
Energy expenditures	**$4,095**	**$4,160**	**$4,182**	**$3,757**	**$3,679**
Energy expenditures as share of total expenditures	6.5%	6.4%	6.4%	5.1%	7.8%
Energy expenditures as share of income	5.7%	5.6%	5.7%	4.0%	7.0%
Group's share of energy expenditures	100%	88%	84%	4%	12%

Source: U.S. Bureau of Labor Statistics (2023)

Note: Income includes wages, self-employment income, Social Security and retirement payments, interest, dividends, rental income and other property income, public assistance, unemployment and workers' compensation, veterans' benefits, and regular contributions for support.

Table 28. Energy Expenditures by Race or Ethnicity, 2022

	All Consumer Units	Hispanic	Non-Hispanic	Non-Hispanic White, other Races	Non-Hispanic Black
Number of consumer units (thousands)	132,242	17,921	114,321	96,992	17,328
Income before taxes	$82,852	$64,577	$85,717	$90,734	$57,632
Income after taxes	$71,487	$60,235	$73,251	$76,983	$52,366
Average annual expenditures	$63,036	$54,734	$64,350	$67,370	$47,213
Natural gas	$416	$371	$423	$426	$407

Table 28. Energy Expenditures by Race or Ethnicity, 2022

	All Consumer Units	Hispanic	Non-Hispanic	Non-Hispanic White, other Races	Non-Hispanic Black
Electricity	$1,472	$1,433	$1,478	$1,487	$1,426
Fuel oil and other fuels	$113	$31	$126	$139	$51
Gasoline, other fuels, and motor oil (transportation)	$2,094	$2,438	$2,040	$2,083	$1,798
Energy expenditures	**$4,095**	**$4,273**	**$4,067**	**$4,135**	**$3,682**
Energy expenditures as share of total expenditures	6.5%	7.8%	6.3%	6.1%	7.8%
Energy expenditures as share of income	5.7%	7.1%	5.6%	5.4%	7.0%
Group's share of energy expenditures	100%	14%	86%	74%	12%

Source: U.S. Bureau of Labor Statistics (2023)

Note: Income includes wages, self-employment income, Social Security and retirement payments, interest, dividends, rental income and other property income, public assistance, unemployment and workers' compensation, veterans' benefits, and regular contributions for support.

The CES data summarized in this section highlight the higher energy burdens experienced by low-income, Black, and Hispanic households under baseline conditions. The proposed rule may increase energy prices, which could exacerbate existing inequalities in energy burden.

EPA assessed the potential electricity price impacts of the proposed ELG on household electricity costs assuming, as a worst-case scenario, that utilities may pass on all compliance costs to ratepayers. This analysis, which is detailed in Chapter 7 of the RIA (U.S. EPA, 2024c), suggests very small potential changes in electricity costs as a result of the final rule. At the national level, upper bound average compliance costs per residential households for Option B are $3.14 per year. These costs vary across North American Electric Reliability Corporation (NERC)[44] regions (see Figure 8), however, with average compliance costs per residential households ranging from $0.19 per year in Northeast Power Coordinating Council (NPCC) to $5.44 per year in SERC Reliability Corporation (SERC). EPA also looked at the distribution of the potential increases in household electricity costs across types of systems as characterized by the ownership type of each plant (*e.g.,* utility, municipal, cooperative). This analysis found that residential consumers served by cooperatives may see the greatest average increase, between $6.73 and $19.26 per year, assuming cooperatives pass on all compliance costs to ratepayers.

As described above, lower-income households spend less, in the absolute, on energy than do higher-income households, but energy expenditures represent a larger share of their income. Therefore, electricity price increases tend to have a relatively larger effect on lower-income households, compared to higher-income households. While the incremental burden relative to income is not distributionally neutral, *i.e.,* any increase would affect lower-income households to a greater extent than higher-income households, the final rule is expected to have a very small impact in the absolute across all regions analyzed. The potential price increases across regions under the upper bound cost scenario represent between less than 0.1 percent and 0.2 percent of energy expenditures for all income, race groups, and income quintiles. These same increases represent between less than 0.1 percent and 0.5 percent of just

1. NERC regions include Midwest Reliability Organization (MRO), Northeast Power Coordinating Council (NPCC), Reliability First Corporation (RF), SERC Reliability Corporation (SERC), Western Electricity Coordinating Council (WECC), Texas Reliability Entity (TRE), Alaska Systems Coordinating Council (ASCC), and Hawaii Coordinating Council (HICC). Compliance costs are zero in both the ASCC and HICC regions.

electricity expenditures. Furthermore, these small impacts may be further moderated by existing pricing structures.

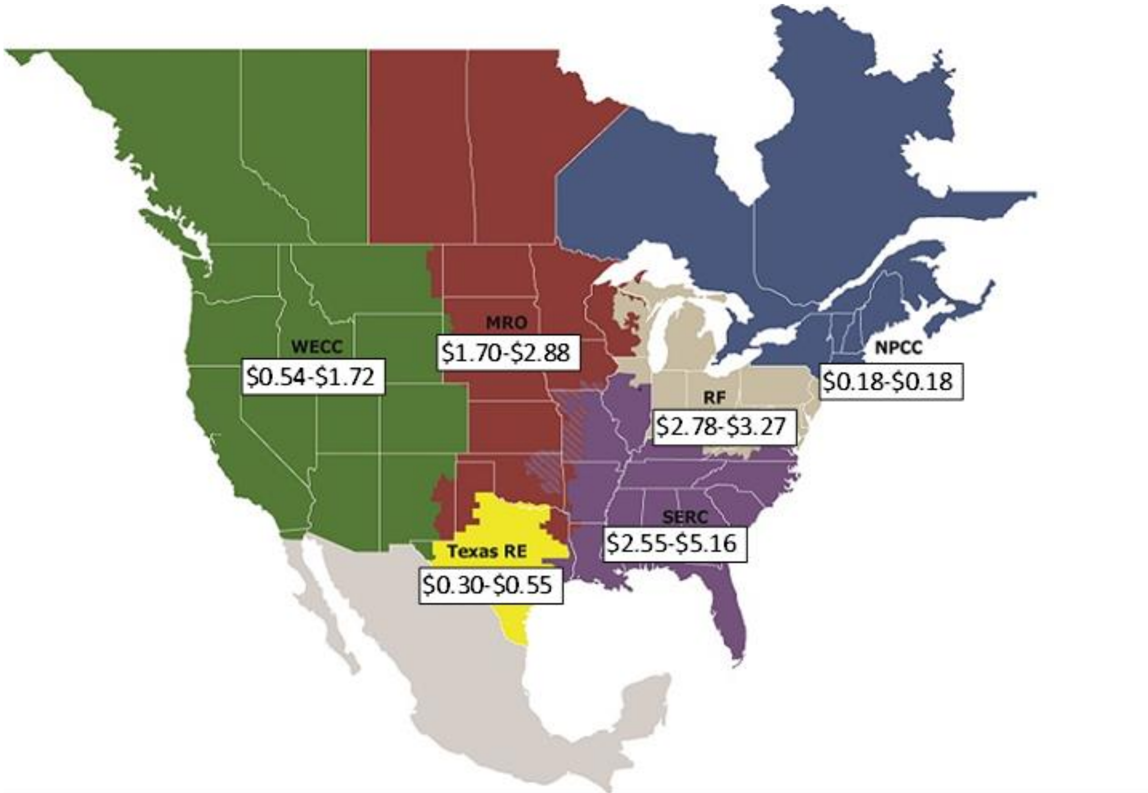

Figure 8. Range of Estimated Average Annual Compliance Costs of the Proposed Rule (Option B) per Residential Household under the Lower and Upper Bound Cost Scenarios, by NERC Region

6. Limitations and Uncertainties

Table 29 through Table 35 summarize the limitations and uncertainties of EPA's distributional analysis and their potential effects on the analysis.

As discussed in Section 4.1, the analysis of pollutant exposure focuses on the three principal wastestreams from steam electric power plants: FGD wastewater, BA transport water and CRL. The analysis does not account for legacy wastewater discharges or CRL discharged from landfills, surface impoundments, or other features via groundwater, which a permitting authority may deem, on a case-by-case basis, to be functionally equivalent to a direct discharge. This omission has an uncertain effect on the distributional effects of the rule as it would depend on the geographical distribution of the loads and changes thereof under the regulatory options.

Table 29. Limitations and Uncertainties of EPA's Nationwide Proximity Analysis

Uncertainty/Limitation	Effect on Analysis	Notes
EPA used independent one-mile and three-mile buffers around steam electric plant locations to identify potentially affected populations.	Uncertain	A CBG may overlap with the buffer areas of multiple steam electric plants. As a result, some individuals may be double counted when generating associated statistics. This limitation only affects around 2 percent of CBGs that fall within the buffer areas.
EPA used proximity to the steam electric power plants or waters receiving FGD wastewater, BA transport water and CRL discharges to identify potentially affected populations.	Uncertain	Steam electric power plants may also affect populations living near landfills receiving CCRs or waters receiving CRL via groundwater. To the extent that these impacts occur away from the locations included in the analysis, the number of people and socioeconomic characteristics of affected populations may be different than reported in Section 3.
For some systems lacking data in the Hydroshare Community Water Systems Service Boundaries (CWSSB) dataset (SimpleLab EPIC, 2022), EPA relied on the zip code reported for the system in the SDWIS dataset to define the service area.	Uncertain	The zip codes reported in the SDWIS dataset represent the zip codes associated with the location of the system, which may not in all cases accurately represent the zip code(s) served by the system.

Table 30. Limitations and Uncertainties of EPA's Distributional Analysis of Air Impacts

Uncertainty/Limitation	Effect on Analysis	Notes
EPA used population projections from the Woods and Poole dataset to analyze the distribution of $PM_{2.5}$ and ozone exposures among various population groups.	Uncertain	There is uncertainty in the population projections generated in the Woods & Poole (2015) dataset. The Woods and Poole database contains county-level projections of population by age, sex, and race out to 2050, relative to a baseline using the 2010 Census data. Population projections for each county are determined simultaneously with every other county in the U.S to consider patterns of economic growth and migration. Underlying the population projections are forecasted variables such as income, employment, and population. Each of these forecasts require many assumptions: economy-wide modeling to project income and employment, net migration rates based on employment opportunities and taking into account fertility and mortality, and the estimation of age/sex/race distributions at the county-level based on historical rates of mortality, fertility, and migration. To the extent these patterns and assumptions have changed since the population projections were estimated, and to the extent that these patterns and assumptions may change in the future, we would expect the projections of future population would be different than those used in this analysis.
The baseline does not account for several pending regulatory actions and newly enacted statutory provisions.	Uncertain	The pending regulatory actions not included in the baseline include regulatory actions that EPA is proposing for the near terms and impacts of the Inflation Reduction Act.
EPA used two air pollutant metrics, MDA8 (ppb) and average annual $PM_{2.5}$ concentrations ($\mu g/m^3$) which are used to evaluate longer-term exposures that have been linked to adverse health effects.	Uncertain	The analysis does not evaluate distributional disparities in other potentially health-relevant metrics like shorter-term exposures to ozone and $PM_{2.5}$.
EPA's analysis was limited to assessing distributional disparities in $PM_{2.5}$ and ozone exposures	Uncertain	The analysis did not extend to assess distributional disparities in health effects from $PM_{2.5}$ and ozone exposures given the relatively small changes in $PM_{2.5}$ and ozone concentrations resulting from Option 3 and additional uncertainties associated with

Table 30. Limitations and Uncertainties of EPA's Distributional Analysis of Air Impacts

Uncertainty/Limitation	Effect on Analysis	Notes
		estimating health effects stratified by population group and valuing those effects.

Table 31. Limitations and Uncertainties of EPA's Distributional Analysis of Immediate Receiving Water Impacts

Uncertainty/Limitation	Effect on Analysis	Notes
IRW modeling is based on annual-average pollutant loadings from the evaluated wastestreams at steam electric power plants and annual-average flow rates within the immediate receiving waters and does not consider temporal variability or potential for pollutants to accumulate in the environment over extended discharge periods covering multiple years.	Underestimate	Uncertain effect regarding water quality distributional analysis. Likely underestimated effects for impacts to wildlife and human health impacts due to long-term accumulation.
Pollutant loading estimates are based on average pollutant concentrations, not site-specific data.	Uncertain	Likely results in overestimate of benchmark exceedances for some immediate receiving waters and underestimate of benchmark exceedances at other immediate receiving waters.
Modeling does not take into consideration pollutant speciation within the receiving stream.	Overestimate	This limitation is particularly relevant to the wildlife impact analysis, as many of the ecological impacts are tied to a specific pollutant species. For example, inorganic arsenic is typically more toxic to aquatic life than organic arsenic. This limitation results in a potential overestimation of the number of immediate receiving waters with exceedances of water quality benchmark values for inorganic forms of the pollutant (*e.g.,* the human health NRWQC for arsenic).
National-scale modeling assumptions that: (1) Do not include site-specific details or detailed modeling of pollutants within the receiving water, (2) are used to estimate pollutant concentrations in the fish tissue and to evaluate wildlife impacts, and (3) Are used to estimate human exposure impacts.	Uncertain	(1) See the 2020 EA for details (U.S. EPA, 2020). An example of this can be found in Exhibit E which details input provided by community members in Florida regarding reverse tidal flows contributing to pollutant loadings from the local steam electric power plant contaminating a local river. (2) See Appendix D of the 2023 EA for details (U.S. EPA, 2023a). (3) Individual exposure factors, such as ingestion rate, body weight, and exposure duration, are variable due to physical

Table 31. Limitations and Uncertainties of EPA's Distributional Analysis of Immediate Receiving Water Impacts

Uncertainty/Limitation	Effect on Analysis	Notes
		characteristics, activities, and behavior of the individual.
Does not take into account ambient background pollutant concentrations or contributions from other point and nonpoint sources and other wastestreams that may be discharged from the steam electric power plant.	Underestimate	EPA's pollutant loadings analysis and IRW Model runs specifically evaluate the changes in pollutant loadings that result from the regulatory options considered under the proposed supplemental rule. Pollutant loadings from other wastestreams at steam electric power plants are assumed to remain the same under baseline and option scenarios and are therefore not considered in the analysis. Because of this approach, the modeling likely underestimates the number and magnitude of benchmark value exceedances at baseline and under the regulatory options, which contributes to uncertainty in the number of environmental and human health improvements or impacts under the proposed rule and evaluated regulatory options relative to baseline.
Does not consider cumulative risks across exposure pathways for ecological receptors and subsistence and recreational fishers.	Underestimate	Because many of the pollutants considered in this analysis are bioaccumulative in nature, the model considers only ingestion of the food source (fish), because it is likely that the dose from the food source is far greater than the dose from water ingestion or direct contact with receiving waters.
The diet of the ecological receptors consists entirely of fish inhabiting the immediate receiving water and that all fish consumed by subsistence and recreational fishers (excluding two weeks per year) are caught in the immediate receiving water.	Overestimate	This assumption potentially overestimates the annual-average daily dose of the pollutants, particularly for recreational fishers. The proportion of fish eaten by an individual from local surface waters will vary (*e.g.,* consumption rate estimates in studies might include seafood purchased from a grocery store and not locally caught).

Table 32. Limitations and Uncertainties of EPA's Distributional Analysis of Downstream Surface Water Impacts

Uncertainty/Limitation	Effect on Analysis	Notes
The IEUBK model does not capture very small changes.	Negligible	The analysis of human health effects from reductions in lead exposure uses the Integrated Exposure Uptake Biokinetic (IEUBK) model geometric mean blood lead (BLL) values for each cohort in each CBG under the baseline and the regulatory options. The IEUBK model processes daily intake to two decimal places (µg/day),and is not sensitive to some small changes between the baseline and regulatory options. As estimated reductions in adverse health effects are driven by very small changes across large populations, this aspect of the model contributes to potential underestimation of the lead-related health effects in children in the different subgroups.
EPA estimated that all fishers travel up to 50 miles.	Uncertain	Certain subpopulations (*e.g.*, low-income and subsistence fishers) may tend to fish closer to home. To the extent that these people fish predominantly from waters receiving discharges from steam electric power plants, they may be exposed to relatively higher concentrations of pollutants. Conversely, people who live farther from steam electric power plants may predominantly fish from waters not affected by pollutants in steam electric power plant discharges and be exposed to relatively lower concentrations of pollutants.
As data are not available on the share of the fishing population that practices subsistence fishing, EPA assumed that, uniformly across the population (*i.e.,* no distinction between race and ethnicity, income, or other factors), five percent of people who fish practice subsistence fishing. This is based on the assumed 95th percentile fish consumption rate for this population in EPA's Exposure Factors Handbook (U.S. EPA, 2011).	Underestimate	Subsistence fishers may represent a relatively larger share of subpopulations of interest for potential EJ concerns. This could increase inequities in the baseline and affect the extent to which the regulatory options may mitigate these inequities.
EPA applied uniform fishing participation rates and catch and release practices across the entire population.	Uncertain	Differences in behavior across socioeconomic groups may result in a

Table 32. Limitations and Uncertainties of EPA's Distributional Analysis of Downstream Surface Water Impacts

Uncertainty/Limitation	Effect on Analysis	Notes
		different distribution of baseline and regulatory option impacts.

Table 33. Limitations and Uncertainties of EPA's Distributional Analysis of Drinking Water Impacts

Uncertainty/Limitation	Effect on Analysis	Notes
EPA's analysis of the distribution of drinking water impacts focuses on the *changes* in TTHM concentrations, bladder cancer cases, and excess bladder cancer deaths across drinking water systems under each of the regulatory options.	Uncertain	EPA's analysis does not quantify the baseline distribution of TTHM concentrations, bladder cancer cases, and excess bladder cancer deaths across drinking water systems, but instead focuses on the *change* resulting from the regulatory options. The analysis does not provide insight into any existing distributional disparities in the baseline, such as poorer communities being less able to afford treatment system upgrades to mitigate TTHM formation, leading to higher levels of TTHM concentrations and incidence of bladder cancer cases and deaths-among populations served by affected drinking water systems.

Table 34. Limitations and Uncertainties of EPA's Distributional Analysis of Cumulative Risks

Uncertainty/Limitation	Effect on Analysis	Notes
EPA estimated the distribution of cumulative risks across human health endpoints for only mixtures of pollutants discharged to surface waters from the evaluated wastestreams included in the steam electric supplemental rule.	Underestimate	The analysis did not extend to pollutant loadings from other wastestreams present at steam electric power plants or contributions from other point or nonpoint sources. EPA's pollutant loadings analysis and cumulative impacts modeling runs specifically evaluate the changes in pollutant loadings that result from the regulatory options considered under the proposed supplemental rule. Pollutant loadings from other wastestreams at steam electric power plants are assumed to remain the same under baseline and option scenarios and are not considered in the analysis. Therefore, the pollutant loadings considered in the analysis are an

Table 34. Limitations and Uncertainties of EPA's Distributional Analysis of Cumulative Risks

Uncertainty/Limitation	Effect on Analysis	Notes
		underestimate of the total potential cumulative risk across human health endpoints posed by steam electric discharges to the environment.
Exposure concentrations for all pollutants except lead in the cumulative risk analysis are based only on steam electric power plant discharges and do not reflect other potential pollutant sources in the vicinity.	Underestimate	The cumulative risk analysis did not consider pollutant loadings emitted from other sources near the affected communities. Lead blood concentrations used in the cumulative analysis were the exception. The IEUBK model, used to estimate lead blood concentrations, considered lead contributions from soil, dust, air, and water, in addition to lead contributions from fish consumption from waters that receive discharges of the evaluated wastestreams. During public meetings held by EPA with communities with EJ concerns, participants often cited multiple sources of pollution in their communities in addition to the local plants that were of concern. This suggests a potential underestimation of distributional disparities in cumulative risks among affected communities.
EPA limited the cumulative risks assessment across human health endpoints for only mixtures of pollutants with a published Interaction Profile.	Underestimate	EPA identified only five pollutants (*i.e.,* arsenic, cadmium, lead, methylmercury, and zinc) in the IRW Model with published ATSDR Interaction Profiles. EPA did not estimate cumulative risks across human health endpoints for mixtures of the remaining four pollutants in the IRW Model. There may be additional mixtures of concern that result in cumulative impacts to communities not represented in the analysis.
Results from the analysis are limited to the distribution of cumulative risks across human health endpoints for only child cohorts under the age of 11 years old.	Underestimate	Lead is included in all three pollutant mixtures evaluated in the cumulative risk analysis. The IEUBK model only determines blood lead concentrations for children under the age of seven years old. Therefore, the cumulative risk analysis for the methylmercury-lead and lead-zinc mixtures are limited to child cohorts under the age of 11 years old (based on crosswalk of age groups). Arsenic-lead-cadmium mixtures may also be limited to the under 11 years old child cohorts if arsenic or cadmium

Table 34. Limitations and Uncertainties of EPA's Distributional Analysis of Cumulative Risks

Uncertainty/Limitation	Effect on Analysis	Notes
		endpoint-specific HQ values are not greater than or equal to 0.1.

Table 35. Limitations and Uncertainties of EPA's Distributional Analysis of Costs and Benefits

Uncertainty/Limitation	Effect on Analysis	Notes
EPA's analysis of benefits focused on a subset of benefits from the proposed regulation, *e.g.,* benefits from air pollution reductions from steam electric power plants.	Underestimation	EPA's benefits analysis did not value potential additional benefits resulting from the proposed rule. For example, in EPA's public meetings, community members discussed predominantly using bottled water for drinking water and everyday household activities given their concerns about pollutants in their drinking water from steam electric power plants and emphasized the high cost of doing so.
EPA's analysis of benefits from the proposed rule evaluated benefits for the time period 2025-2049.	Underestimate	EPA's analysis did not calculate benefits to affected populations from the proposed rule after 2049, and therefore may not capture longer-term effects on economic disparities that may exist under the baseline. For example, in EPA's public meetings, community members noted long-term economic losses in their communities due to water pollution from steam electric power plants damaging key industries like recreational tourism. Improvements in water quality in these communities as a result of the proposed rule, therefore, may have long-term benefits from reducing averting behaviors and restoring livelihoods in that may not be fully captured in the benefits analysis.
EPA's analysis of the distribution of costs focused on evaluating the distribution of the changes in household electricity prices under the proposed rule.	Underestimate	EPA's analysis of the distribution of costs did not capture other costs with potential disparities that may be incurred by affected communities as a result of the proposed rule.
EPA's distributional analysis of benefits and costs qualitatively discusses potential differences in apportionment of costs and benefits among population groups of concern.	Uncertain	EPA was not able to quantitatively analyze the apportionment of costs and benefits among population groups of concern given the lack of information about how different costs and benefits may be incurred across population groups. For example, there is uncertainty about how

Table 35. Limitations and Uncertainties of EPA's Distributional Analysis of Costs and Benefits

Uncertainty/Limitation	Effect on Analysis	Notes
		to value benefits from air quality improvements across various racial/ethnic groups.

7. Conclusions

Overall, EPA's EJ analysis showed that the extent to which the technologies steam electric power plants implement to control wastewater discharges will reduce differential baseline exposures for low-income populations and people of color in affected communities to pollutants in wastewater and resulting human impacts varies. In particular, benefits associated with improvements to water quality, wildlife, and human health resulting from reductions in pollutants in surface water will accrue to some low-income populations and people of color at a higher rate under some or all of the regulatory options. Benefits associated with drinking water will accrue to people of color and low-income populations at a higher rate under the final rule. Remaining exposures, impacts, costs, and benefits analyzed either accrue at a higher rate to populations which are not people of color or low-income, accrue proportionately to all populations, or are small enough that EPA could not conclude whether changes in disproportionate impacts would occur. While the changes in GHGs attributable to the final rule are small compared to worldwide emissions, findings from peer-reviewed evaluations demonstrate that actions that reduce GHG emissions are also likely to reduce climate-related impacts on vulnerable communities, including low-income communities and communities of color.

8. References

Casey, J. A., Su, J. G., Henneman, L. R. F., Zigler, C., Neophytou, A. M., Catalano, R., Gondalia, R., . . . Barrett, M. A. (2020). Improved asthma outcomes observed in the vicinity of coal power plant retirement, retrofit and conversion to natural gas. *Nature Energy*, *5*(5). https://doi.org/10.1038/s41560-020-0600-2

Drehobl, A., Ross, L., & Ayala, R. (2020). *How High Are Household Energy Burdens?* . https://www.aceee.org/research-report/u2006

Ebi, K. L., Balbus, J. M., Luber, G., Bole, A., Crimmins, A., Glass, G., Saha, S., . . . White-Newsome, J. L. (2018). *Human Health* (Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Issue.

Exec. Order No. 12866. (1993). *58 FR 51735: Regulatory Planning and Review*. Retrieved from https://www.archives.gov/files/federal-register/executive-orders/pdf/12866.pdf

Exec. Order No. 12898. (1994). *59 FR 7629: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*. Retrieved from https://www.archives.gov/files/federal-register/executive-orders/pdf/12898.pdf

Exec. Order No. 13985. (2021). *86 FR 7009: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*. Retrieved from https://www.federalregister.gov/documents/2021/01/25/2021-01753/advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government

Exec. Order No. 14008. (2021). *86 FR 7619: Tackling the Climate Crisis at Home and Abroad*. Retrieved from https://www.regulations.gov/document/EPA-HQ-OPPT-2021-0202-0012

Exec. Order No. 14096. (2023). *88 FR 25251: Revitalizing Our Nation's Commitment to Environmental Justice for All*. Retrieved from https://www.regulations.gov/document/EPA-HQ-OPPT-2021-0202-0012

Henneman, L. R. F., Rasel, M. M., Choirat, C., Anenberg, S. C., & Zigler, C. (2023). Inequitable Exposures to U.S. Coal Power Plant–Related PM2.5: 22 Years and Counting. *Environmental Health Perspectives*, *131*(3). https://doi.org/10.1289/EHP11605

Hinck, J. E., Schmitt, C. J., Chojnacki, K. A., & Tillitt, D. E. (2009). Environmental Contaminants in Freshwater Fish and Their Risk to Piscivorous Wildlife Based on A National Monitoring Program. *Environmental Monitoring and Assessment*, *152*, 469-494. https://doi.org/https://doi.org/10.1007/s10661-008-0331-5

IPCC. (2018). *Global Warming of 1.5°C: An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty*.

Israel, B., & The Daily Climate. (2012). Coal Plants Smother Communities of Color. *Scientific American*. https://www.scientificamerican.com/article/coal-plants-smother-communities-of-color/#:~:text=People%20living%20near%20coal%20plants,percent%20are%20people%20of%20color

Jantarasami, L., Delgado, R., Marino, E., McNeeley, S., Narducci, C., Raymond-Yakoubian, J., Singletary, L., . . . Whyte, K. P. (2018). *Tribes and Indigenous Peoples* (Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Issue. https://nca2018.globalchange.gov/chapter/15/

Kosmicki, S., & Long, M. (2016). *Exploring Environmental Inequality Within US Communities Containing Coal and Nuclear Power Plants*. Springer, Cham. https://doi.org/https://doi.org/10.1007/978-3-319-18081-6_6

Liévanos, R. S., Greenberg, P., & Wishart, R. (2018). In the Shadow of Production: Coal Waste Accumulation and Environmental Inequality Formation in Eastern Kentucky. *Social Science Research*, *71*, 37-55.

Lyubich, E. (2020). *The Race Gap in Residential Energy Expenditures* (306). UC Berkeley Energy Institute at Haas. https://haas.berkeley.edu/wp-content/uploads/WP306.pdf

NAACP. (2012). *Coal Blooded: Putting Profits Before People*. https://naacp.org/resources/coal-blooded-putting-profits-people

National Academies of Sciences, E., and Medicine,. (2017). *Communities in Action: Pathways to Health Equity*. The National Academies Press. https://doi.org/10.17226/24624

National Research Council. (2011). *America's Climate Choices*. The National Academies Press. https://doi.org/10.17226/12781

OMB (Office of Management and Budget). (2023). *Circular A-4*. Retrieved from https://www.whitehouse.gov/wp-content/uploads/2023/11/CircularA-4.pdf

Oppenheimer, M., Campos, M., Warren, R., Birkmann, J., Luber, G., O'Neill, B., & Takahashi, K. (2014). *Emergent Risks and Key Vulnerabilities* (Climate Change 2014: Impacts, Adaptation, and Vulnerability. , Issue. C. U. Press. https://www.ipcc.ch/report/ar5/wg2/emergent-risks-and-key-vulnerabilities/

Porter, J. R., Xie, L., Challinor, A. J., Cochrane, K., Howden, S. M., Iqbal, M. M., Lobell, D. B., . . . Travasso, M. I. (2014). *Food Security and Food Production Systems* (Climate Change 2014: Impacts, Adaptation, and Vulnerability. , Issue. C. U. Press. https://www.ipcc.ch/report/ar5/wg2/food-security-and-food-production-systems/

Reames, T. G. (2016). Targeting Energy Justice: Exploring Spatial, Racial/Ethnic and Socioeconomic Disparities in Urban Residential Heating Energy Efficiency. *Energy Policy*, *97*, 549-558. https://doi.org/10.1016/j.enpol.2016.07.048

SimpleLab EPIC. (2022). U.S. Community Water Systems Service Boundaries v2.4.0 HydroShare. http://www.hydroshare.org/resource/20b908d73a784fc1a097a3b3f2b58bfb

Smith, K. R., Woodward, A., Campbell-Lendrum, D., Chadee, D. D., Honda, Y., Liu, Q., Olwoch, J. M., . . . Sauerborn, R. (2014). *Human Health: Impacts, Adaptation, and Co-benefits* (Climate Change 2014: Impacts, Adaptation, and Vulnerability. , Issue. C. U. Press. https://www.ipcc.ch/report/ar5/wg2/human-health-impacts-adaptation-and-co-benefits/

Tessum, C. W., Apte, J. S., Goodkind, A. L., Muller, N. Z., Mullins, K. A., Paolella, D. A., Polasky, S., . . . Hill, J. D. (2019). Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure. *Proceedings of the National Academy of Sciences*, *116*(13). https://doi.org/10.1073/pnas.1818859116

Thind, M. P. S., Tessum, C. W., Azevedo, I. L., & Marshall, J. D. (2019). Fine Particulate Air Pollution from Electricity Generation in the US: Health Impacts by Race, Income, and Geography. *Environmental Science & Technology*, *53*(23). https://doi.org/10.1021/acs.est.9b02527

U.S. Bureau of Labor Statistics. (2023). *Table 1101. Quintiles of income before taxes: Annual expenditure means, shares, standard errors, and relative standard errors*. https://www.bls.gov/cex/tables/calendar-year/mean-item-share-average-standard-error.htm#cu-income

U.S. Census Bureau. (2022a). *American Community Survey (ACS)*. https://www.census.gov/programs-surveys/acs

U.S. Census Bureau. (2022b). *TIGER/Line Shapefiles*. https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html

U.S. Environmental Protection Agency. (2015a). *Environmental Assessment for the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*. (EPA 821-R-15-006).

U.S. Environmental Protection Agency. (2015b). *Guidance on Considering Environmental Justice during the Development of Regulatory Actions*. Retrieved from http://www.epa.gov/environemntaljustice/resources/plicy/ej-rulemaking.html

U.S. Environmental Protection Agency. (2016). *Technical Guidance for Assessing Environmental Justice in Regulatory Analysis*. Retrieved from https://www.epa.gov/sites/default/files/2016-06/documents/ejtg_5_6_16_v5.1.pdf

U.S. Environmental Protection Agency. (2018). *Documentation for EPA's Power Sector Modeling Platform v6 Using the Integrated Planning Model*. 1200 Pennsylvania Avenue, NW, Washington D.C. 20460

U.S. Environmental Protection Agency. (2020). *Supplemental Environmental Assessment for Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*.

U.S. Environmental Protection Agency. (2022). *Regulatory Impact Analysis for Proposed Federal Implementation Plan Addressing Regional Ozone Transport for the 2015 Ozone National Ambient Air Quality Standard*. (EPA-452/D-22-001). Retrieved from https://www.epa.gov/system/files/documents/2022-03/transport_ria_proposal_fip_2015_ozone_naaqs_2022-02.pdf

U.S. Environmental Protection Agency. (2023a). *Environmental Assessment for Proposed Supplemental Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*.

U.S. Environmental Protection Agency. (2023b). *Environmental Justice Analysis for Proposed Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*.

U.S. Environmental Protection Agency. (2024a). *Benefit and Cost Analysis for Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*. (821-R-24-006).

U.S. Environmental Protection Agency. (2024b). *Environmental Assessment for Supplemental Effluent Guidelines and Standards for the Steam Electric Power Generating Point Source Category*. (821-R-24-005).

U.S. Environmental Protection Agency. (2024c). *Regulatory Impact Analysis for Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*. (821-R-24-007).

U.S. Environmental Protection Agency. (2024d). *Response to Comments for Supplemental Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*.

U.S. Environmental Protection Agency. (2024e). *Technical Development Document for Supplemental Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*. (821-R-24-004).

U.S. EPA. (2009). *Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act; Final Rule*.

U.S. EPA. (2011). *Exposure Factors Handbook 2011 Edition (Final Report)*. (EPA/600/R-09/052F). Washington, DC: U.S. Environmental Protection Agency

U.S. EPA. (2016). *Technical Guidance for Assessing Environmental Justice in Regulatory Analysis*. Retrieved from https://www.epa.gov/environmentaljustice/technical-guidance-assessing-environmental-justice-regulatory-analysis

U.S. EPA. (2019a). *Integrated Risk Information System (IRIS)*. (EPA-HQ-OW-2009-0819-9002). Washington, DC: U.S. Environmental Protection Agency Retrieved from http://www.epa.gov/IRIS/

U.S. EPA. (2019b). *Integrated Science Assessment (ISA) for Particulate Matter (Final Report)*. (EPA/600/R-19/188). Research Triangle Park, NC: U.S. Environmental Protection Agency Retrieved from https://www.epa.gov/naaqs/particulate-matter-pm-standards-integrated-science-assessments-current-review

U.S. EPA. (2021). *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts*. (EPA 430-R-21-003). Retrieved from www.epa.gov/cira/social-vulnerability-report

U.S. EPA. (2022a). *Environmental Justice: Learn About Environmental Justice*. https://www.epa.gov/environmentaljustice/learn-about-environmental-justice

U.S. EPA. (2022b). *Supplement to the 2019 Integrated Science Assessment for Particulate Matter (Final Report)*. (EPA/600/R-22/028). Research Triangle Park, NC: U.S. Environmental Protection Agency Retrieved from https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter

U.S. EPA. (2023). *Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Legacy CCR Surface Impoundments*. (EPA–HQ–OLEM–2020–0107). U.S. Environmental Protection Agency Retrieved from https://www.regulations.gov/document/EPA-HQ-OLEM-2020-0107-0119

USGCRP. (2016). *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.* http://dx.doi.org/10.7930/J0R49NQX

USGCRP. (2018). *Impacts, Risks, and Adaptation in the United States* (Fourth National Climate Assessment, Issue.

Woods & Poole. (2015). *Complete Demographic Database*. https://www.woodsandpoole.com/

APPENDIX A: Results from the Proximity Analysis of Downstream Surface Waters

This section of the appendix presents the results of the nationwide proximity analysis EPA conducted to assess the socioeconomic characteristics of communities living in proximity (within 50 miles) of a downstream surface water receiving discharges from steam electric power plants. The socioeconomic results presented are for Period 1 which covers the years 2025 through 2029 when the universe of plants would transition from current (baseline) treatment practices to practices that achieve the revised effluent limits.

Table A-1. Percent of the Population Living within 50 Miles of an Affected Downstream Reach with Modeled Concentrations of Selected Pollutants under the Regulatory Options Identifying as Low-Income Compared to the National Average (Period 1)

Pollutant	Changes in Concentrations	Percentage of Reaches			Percent Low-Income		
		Option A	Option B	Option C	Option A	Option B	Option C
Antimony	Decreases	87.2%	87.7%	88.3%	12.6%	12.6%	12.6%
	No changes	11.3%	10.7%	10.1%	14.6%	14.6%	14.8%
Arsenic	Decreases	87.2%	87.7%	88.3%	12.6%	12.6%	12.6%
	No changes	12.8%	12.3%	11.7%	14.4%	14.4%	14.5%
Cadmium	Decreases	87.2%	87.7%	88.3%	12.6%	12.6%	12.6%
	No changes	12.8%	12.3%	11.7%	14.4%	14.4%	14.5%
Cyanide(a)	Decreases	31.3%	31.3%	35.1%	13.6%	13.6%	13.6%
	No changes	5.9%	5.9%	2.1%	13.1%	13.1%	13.2%
Lead(a)	Decreases	56.8%	56.8%	56.8%	12.2%	12.2%	12.2%
	No changes	10.0%	10.0%	10.0%	13.6%	13.6%	13.6%
Manganese	Decreases	87.2%	87.7%	88.3%	12.6%	12.6%	12.6%
	No changes	12.8%	12.3%	11.7%	14.4%	14.4%	14.5%
Mercury	Decreases	87.2%	87.7%	88.3%	12.6%	12.6%	12.6%
	No changes	12.8%	12.3%	11.7%	14.4%	14.4%	14.5%
Thallium	Decreases	87.2%	87.7%	88.3%	12.6%	12.6%	12.6%
	No changes	12.8%	12.3%	11.7%	14.4%	14.4%	14.5%
United States							12.9%

Source: U.S. EPA analysis, 2024

Notes:

Not all of the steam electric plants discharged cyanide and lead. The associated socioeconomic characteristic information is only for the set of reaches with non-zero loadings for those pollutants.

Table A-2. Percent of the Population Living within 50 Miles of an Affected Downstream Reach with Modeled Concentrations of Selected Pollutants under the Regulatory Options Identifying as a Racial or Ethnic Minority Compared to the National Average (Period 1)

Pollutant	Changes in Concentrations	Percent of Reaches			Percent African American			Percent Asian			Percent Native Hawaiian/Pacific Islander		
		Option A	Option B	Option C	Option A	Option B	Option C	Option A	Option B	Option C	Option A	Option B	Option C
Antimony	Decreases	87.2%	87.7%	88.3%	15.1%	15.2%	15.1%	3.8%	3.8%	3.8%	0.1%	0.1%	0.1%
	No changes	11.3%	10.7%	10.1%	18.4%	18.2%	18.9%	2.6%	2.6%	2.6%	0.1%	0.1%	0.1%
Arsenic	Decreases	87.2%	87.7%	88.3%	15.1%	15.1%	15.1%	3.8%	3.8%	3.8%	0.1%	0.1%	0.1%
	No changes	12.8%	12.3%	11.7%	18.1%	18.0%	18.5%	2.5%	2.5%	2.6%	0.1%	0.1%	0.1%
Cadmium	Decreases	87.2%	87.7%	88.3%	15.1%	15.1%	15.1%	3.8%	3.8%	3.8%	0.1%	0.1%	0.1%
	No changes	12.8%	12.3%	11.7%	18.1%	18.0%	18.5%	2.5%	2.5%	2.6%	0.1%	0.1%	0.1%
Cyanide(a)	Decreases	31.3%	31.3%	35.1%	18.1%	18.1%	19.1%	2.7%	2.7%	2.7%	0.1%	0.1%	0.1%
	No changes	5.9%	5.9%	2.1%	18.0%	18.0%	14.0%	4.7%	4.7%	5.7%	0.0%	0.0%	0.0%
Lead(a)	Decreases	56.8%	56.8%	56.8%	14.1%	14.1%	14.1%	3.7%	3.7%	3.7%	0.1%	0.1%	0.1%
	No changes	10.0%	10.0%	10.0%	16.1%	16.1%	16.1%	4.6%	4.6%	4.6%	0.1%	0.1%	0.1%
Manganese	Decreases	87.2%	87.7%	88.3%	15.1%	15.1%	15.1%	3.8%	3.8%	3.8%	0.1%	0.1%	0.1%
	No changes	12.8%	12.3%	11.7%	18.1%	18.0%	18.5%	2.5%	2.5%	2.6%	0.1%	0.1%	0.1%
Mercury	Decreases	87.2%	87.7%	88.3%	15.1%	15.1%	15.1%	3.8%	3.8%	3.8%	0.1%	0.1%	0.1%
	No changes	12.8%	12.3%	11.7%	18.1%	18.0%	18.5%	2.5%	2.5%	2.6%	0.1%	0.1%	0.1%
Thallium	Decreases	87.2%	87.7%	88.3%	15.1%	15.1%	15.1%	3.8%	3.8%	3.8%	0.1%	0.1%	0.1%
	No changes	12.8%	12.3%	11.7%	18.1%	18.0%	18.5%	2.5%	2.5%	2.6%	0.1%	0.1%	0.1%
United States							12.1%			5.6%			0.2%

Source: U.S. EPA analysis, 2024

Notes:

Not all of the steam electric plants discharged cyanide and lead. The associated socioeconomic characteristic information is only for the set of reaches with non-zero loadings for those pollutants.

Table A-3. Percent of the Population Living within 50 Miles of an Affected Downstream Reach with Modeled Concentrations of Selected Pollutants under the Regulatory Options Identifying as a Racial or Ethnic Minority Compared to the National Average (Period 1)

Pollutant	Changes in Concentrations	Percent of Reaches			Percent American Indian/Alaska Native			Percent Other non-Hispanic			Percent Hispanic/Latino		
		Option A	Option B	Option C	Option A	Option B	Option C	Option A	Option B	Option C	Option A	Option B	Option C
Antimony	Decreases	87.2%	87.7%	88.3%	0.4%	0.4%	0.4%	3.3%	3.3%	3.3%	10.9%	10.9%	10.9%
	No changes	11.3%	10.7%	10.1%	0.2%	0.2%	0.2%	2.9%	2.9%	2.9%	16.9%	17.1%	17.9%
Arsenic	Decreases	87.2%	87.7%	88.3%	0.4%	0.4%	0.4%	3.3%	3.3%	3.3%	11.0%	11.0%	10.9%
	No changes	12.8%	12.3%	11.7%	0.2%	0.2%	0.2%	3.0%	3.0%	3.0%	15.6%	15.8%	16.4%
Cadmium	Decreases	87.2%	87.7%	88.3%	0.4%	0.4%	0.4%	3.3%	3.3%	3.3%	11.0%	11.0%	10.9%
	No changes	12.8%	12.3%	11.7%	0.2%	0.2%	0.2%	3.0%	3.0%	3.0%	15.6%	15.8%	16.4%
Cyanide(a)	Decreases	31.3%	31.3%	35.1%	0.2%	0.2%	0.2%	3.2%	3.2%	3.2%	6.5%	6.5%	6.7%
	No changes	5.9%	5.9%	2.1%	0.1%	0.1%	0.1%	2.9%	2.9%	2.8%	18.6%	18.6%	24.7%
Lead(a)	Decreases	56.8%	56.8%	56.8%	0.5%	0.5%	0.5%	3.4%	3.4%	3.4%	7.2%	7.2%	7.2%
	No changes	10.0%	10.0%	10.0%	0.4%	0.4%	0.4%	3.2%	3.2%	3.2%	20.7%	20.7%	20.7%
Manganese	Decreases	87.2%	87.7%	88.3%	0.4%	0.4%	0.4%	3.3%	3.3%	3.3%	11.0%	11.0%	10.9%
	No changes	12.8%	12.3%	11.7%	0.2%	0.2%	0.2%	3.0%	3.0%	3.0%	15.6%	15.8%	16.4%
Mercury	Decreases	87.2%	87.7%	88.3%	0.4%	0.4%	0.4%	3.3%	3.3%	3.3%	11.0%	11.0%	10.9%
	No changes	12.8%	12.3%	11.7%	0.2%	0.2%	0.2%	3.0%	3.0%	3.0%	15.6%	15.8%	16.4%
Thallium	Decreases	87.2%	87.7%	88.3%	0.4%	0.4%	0.4%	3.3%	3.3%	3.3%	11.0%	11.0%	10.9%
	No changes	12.8%	12.3%	11.7%	0.2%	0.2%	0.2%	3.0%	3.0%	3.0%	15.6%	15.8%	16.4%
United States							0.6%			3.5%			19.2%

Source: U.S. EPA analysis, 2024

Notes:

Not all of the steam electric plants discharged cyanide and lead. The associated socioeconomic characteristic information is only for the set of reaches with non-zero loadings for those pollutants.