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Environmental Justice Analysis for Proposed 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
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
PbB	blood lead
PEJC	potential environmental justice concerns
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	ReliabilityFirst 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) defines environmental justice (EJ) as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations and policies" (U.S. EPA, 2021). Four Executive Orders (E.O.s)– E.O. 12898, E.O. 13985, E.O. 14008, and E.O. 12866– call on federal agencies to advance EJ and equity, in developing policies, by analyzing and addressing disproportionately high and adverse impacts on historically underserved, marginalized, and economically disadvantaged people.

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

As research has shown, steam electric power plants are often sited in low-income and minority communities, 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 (NAACP, 2012; Toomey, 2013; Israel, 2012). Therefore, understanding the socioeconomic characteristics of populations expected to be impacted by the proposed regulation is necessary to effectively analyze whether vulnerable populations – like low-income and minority populations - may experience disproportionately high and adverse impacts from exposures to pollutants discharged by steam electric power plants under the baseline and to what extent the regulatory options may mitigate, exacerbate, or create potentially disproportionately high and adverse 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 four proposed regulatory options across all potentially affected communities.

This analysis is divided into several core analyses. These include:

- A literature review of potential EJ concerns (PEJC) related to coal-fired power plants (Section 5).
- 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 6).
- A screening analysis used to identify d affected communities to prioritize for initial public outreach (Section 7).
- A discussion of EPA's approach to planning public meetings, and the results of the public meetings (Section 7).

1. The 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. 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."

- 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 regulatory options (Section 9). The exposure pathways, pollutant exposures, and/or human impacts assessed include:
- Exposure to particulate matter 2.5 ($PM_{2.5}$) 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- and cancer-related – caused by exposure to lead, mercury, and arsenic from consuming fish caught in downstream reaches 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 impacts on 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 10).

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 and minority populations 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 and drinking water will accrue to minority and low-income populations at a higher rate under some or all of the proposed regulatory options, with Options 3 and 4 generating the greatest improvements. Remaining exposures, impacts, costs, and benefits analyzed either accrue at a higher rate to populations that are not minority 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 greenhouse gases (GHGs) attributable to the proposed regulatory options 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 and minority communities.

1. Introduction

1.1 Description of the Effluent Limitations Guidelines Program

Under the authority of the Clean Water Act, 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.

1.2 Steam Electric Power Generating Effluent Guidelines

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 operating as utilities which includes steam electric power plants that use nuclear or fossil fuels (*e.g.,* coal, oil, and natural gas) to produce electricity. 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. For more information on the 2015 rule and the 2020 rule see https://www.epa.gov/eg/steam-electric-power-generating-effluent-guidelines.

1.3 Proposed Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category

EPA's proposed rule contains revised technology-based ELGs for the steam electric power generating point source category for certain wastestreams. EPA proposes changes to, or solicits comment on, limitations for flue gas desulfurization (FGD) wastewater, bottom ash (BA) transport water, combustion residual leachate (CRL), and legacy wastewater at existing sources.

As one of the supplements to the proposed rule, EPA has performed an environmental justice (EJ) analysis. This document presents that analysis.

2. Definitions and Terminology

EPA defines EJ as the "*fair treatment* and *meaningful involvement* of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies" (emphasis added) (U.S. EPA, 2022a).

Fair treatment, as defined by EPA, means that "no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies." 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" (U.S. EPA, 2022a).

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

- A PEJC is defined as "the actual or potential lack of fair treatment or meaningful involvement of minority populations, 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 report uses the term when discussing whether the results of EPA's quantitative and qualitative analyses indicate that there are disproportionate impacts under the baseline and/or regulatory options.
- EPA defines population groups of concern as minority populations,[2] low-income populations, and indigenous peoples. 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 report when referring to the apportionment of impacts among minority, low-income, or indigenous populations as well as individual racial/ethnic population groups (*e.g.,* Hispanic populations).

2. 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. EPA, 2016, p. 6).

3. Executive Orders

This analysis follows guidance on EJ issued to federal agencies through several Executive Orders (E.O.s).

E.O. 12898 (59 FR 7629, February 16, 1994) sets federal executive policy on EJ. It directs federal agencies, to the greatest extent practicable and permitted by law, to make achieving EJ part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States (59 FR 7629, February 16, 1994).

E.O. 13985 (86 FR 7009, January 20, 2021) focuses on creating a "comprehensive approach to advancing equity for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality" (p. 7009). It also calls on agencies to "recognize and work to redress inequities in their policies and programs that serve as barriers to equal opportunity"(86 FR 7009, January 20, 2021, p. 7009).

E.O. 14008 (86 FR 7619, February 1, 2021) calls on federal agencies to make achieving EJ 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" (86 FR 7619, February 1, 2021, p. 7629).

E.O. 12866 (58 FR 51735, October 4, 1993) instructs federal agencies that, when choosing among alternative regulatory options in relation to their preferred regulatory options, they should choose options "that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach" (p. 1). Additionally, the E.O. states that when an agency determines that a regulation is the best available option for achieving the regulatory objective, it should design the regulation in the most cost-effective manner, considering (among several other factors) distributive impacts and equity (58 FR 51735, October 4, 1993).

4. Purpose and Outline of the Environmental Justice Analysis

EPA conducted this analysis to provide a robust assessment of the distribution of pollutant exposures, environmental and human health impacts, and costs and benefits among all populations expected to be affected by the proposed rule.

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 disproportionately high and adverse impacts are experienced by population groups of concern under the baseline and whether the regulatory options evaluated mitigate, exacerbate, or create disproportionately high and adverse impacts among population groups of concern. This analysis also advances the objectives of E.O. 14008 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 disproportionately high 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 screened, with the highest magnitude costs and benefits evaluated to provide an assessment of the distribution of economic impacts among populations expected to be affected by the proposed 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 proposed 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 through public meetings in several affected communities.

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

- Section 5 presents a review of existing literature on potential EJ concerns related to pollution from coal-fired power plants.
- Section 6 presents the results of the nationwide proximity analysis EPA performed as an initial assessment of socioeconomic characteristics of communities living near steam electric power plants and exposure pathways for pollutants discharged from the plants.
- Section 7 presents the methodology EPA used to evaluate the environmental and socioeconomic characteristics of communities expected to be affected by the proposed rule and to identify whether communities had PEJC. This section also presents the methodology EPA used to identify a subset of communities identified as having PEJC to prioritize for initial outreach to solicit input from community members. Finally, this section discusses EPA's initial outreach, including planning public meetings and the results of these meetings.
- Section 8 defines the baseline scenario and each of the regulatory options evaluated in the analysis.
- Section 9 presents the results of the evaluation of the distribution of environmental and/or human health impacts among populations expected to be affected by the proposed rule under the baseline and the regulatory options. The results are shown for each of the pollutant exposure pathways evaluated for the proposed rule–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 proposed rule.
- Section 10 discusses the distribution of benefits and costs of the proposed rule among populations expected to be affected.
- Section 11 discusses the limitations and uncertainties of the EJ analysis.
- Section 12 discusses the conclusions of the EJ analysis.

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

EPA conducted a literature review to identify academic research and articles on EJ concerns related to coal-fired power plants. EPA identified 10 papers that focused on coal-fired power plants and EJ issues, four of which focused on coal-fired power plants in the United States and were considered by the Agency to be directly relevant to the proposed rule. Three of the four papers focused on a large study on coal-fired power plants conducted by the National Association for the Advancement of Colored People (NAACP); the fourth was a study conducted in a coal-producing region evaluating predictors of proximity to older coal waste impoundments. The findings of the literature review are discussed below.

In 2012, the NAACP published a study evaluating 378 coal-fired power plants in the United States based on their EJ performance. A plant's EJ performance was determined using a scoring system based on five factors: emissions of sulfur dioxide (SO_2), emissions of nitrogen oxides (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 results of the study's proximity 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 disproportionately 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 average[3]–and 53 percent were people of color compared to a national average of 36 percent. (NAACP, 2012). While not included in the report, a follow-on article reported that 78 percent of African Americans in the United States live within 30 miles of coal-fired power plants (Toomey, 2013). Latino, indigenous, and low-income communities are on average also more likely to live near coal-fired power plants than the general population (Toomey, 2013). These findings suggest that coal-fired power plants tend to be located in poor, minority, and indigenous communities.

Living near coal-fired power plants can be associated with adverse health impacts. These plants produce air pollutants like SO_2, NO_x, and fine particulate matter ($PM_{2.5}$). 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 are associated with asthma (NAACP, 2012). Asthma has been found to particularly affect African Americans, who are three times more likely, on average, to be hospitalized for asthma than Whites and have a death rate from asthma that is 172 percent higher than for Whites (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 (NAACP, 2012). 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 disproportionate adverse health impacts from exposure to heavy metals, particularly mercury, due to their higher rates of fish consumption (Israel, 2012). These findings suggest that minorities, indigenous populations, and children potentially face disproportionately high and adverse health impacts from exposures to pollutants released by coal-fired power plants into the air and water.

The report also found that coal-fired power plants contribute to climate justice issues through emissions of carbon dioxide (CO_2) which contribute to climate change (NAACP, 2012). 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

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

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, indigenous, minority, elderly, and disabled populations-may face a 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 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 not addressed by the proposed rule, PEJC 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 et al. (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 et al., 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 et al., 2018, p. 51). This suggests PEJC among low-income populations in coal-producing areas with respect to the siting of new coal waste impoundments and potential increased risks of disproportionate adverse impacts as impoundments age and become more susceptible to failure.

6. Nationwide Proximity Analysis

As an initial screening of communities potentially affected by the proposed rule, EPA conducted a nationwide proximity analysis to summarize the socioeconomic characteristics of households living near steam electric power plants, downstream surface waters affected by plant discharges, and drinking water systems potentially affected by plant discharges. This gave EPA an initial assessment of whether communities near steam electric power plants and other sources of exposure to pollutants from the plants were disproportionately composed of population groups of concern relative to national and state averages.

6.1 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 reaches affected by steam electric plant discharges. EPA conducted this analysis for the set of 92 steam electric power plants for which the Agency modeled non-zero pollutant loadings under the baseline or regulatory options.

EPA collected 2015 to 2019 population-specific American Community Survey (ACS) data from the U.S. Census Bureau (2022a) on:

- The percent of the population below the poverty threshold,[4] referred to as "low-income population" in this analysis.
- The percent of the population categorized in various racial/ethnic minority groups.[5]

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 subsumed under the term, "minority group" to determine whether people in these groups are more or less represented in the populations living near steam electric power plants that discharge BA transport water, FGD wastewater, or CRL compared to the respective state and national averages.[6] PEJC may exist in areas where the percent of the population that is low-income and/or minority is higher than the state or national averages.

The distance buffers from the steam electric power plants and their associated immediate receiving reaches[7] 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

4. 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.

5. 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.

6. The minority 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.

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

regulatory options.[8] EPA notes that these are not the only populations that could be affected by steam 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 2015 to 2019 (U.S. Census Bureau, 2022a) to identify minority 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. Table 2 presents this information in terms of the number of plants with population groups of concern above the national average.

As shown in Table 1*,* about 50,000 people live within one mile of at least one steam electric power plant currently discharging BA transport water, FGD wastewater, or CRL to surface waters, and about 600,000 people live within three miles.[9] The proportion of populations within all analyzed regions that are minority (considered as a group, across all racial/ethnic categories) or low-income is smaller than or similar to the national average; however, the comparison of individual analysis regions around each plant to national averages shows that varying shares of communities within each distance buffer have low-income or minority percentages above national averages[10]. In particular, about one third of the individual communities have a higher proportion of low-income people and people who identify as Other (non-Hispanic) than the national average (Table 2).

The simple comparison to the national average may not account for important differences between states, particularly given the non-uniform geographical distribution of steam electric power plants across the country. EPA therefore also compared the demographic profile of communities around each plant to that of the states intersected by each analysis region. Table 3 summarizes the results of this comparison, while Table 4 summarizes the state statistics against which the communities around each plant were compared.

Socioeconomic characteristics at the state and national levels are relatively similar (different by fewer than five individual communities), except for the proportion of people who identify as Native Hawaiian or Pacific Islander (non-Hispanic), people who identify as American Indian or Alaska Native (non-Hispanic), and people who identify as Hispanic or Latino. For these characteristics, exceedances of state averages are greater than exceedances of national averages, especially within the three-mile distance from stream electric plants (Table 3 and Table 4).

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

9. For both buffer distances, around 2 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.

10. A "community" consists of the CBGs within the specified distance of each of the 92 steam electric power plants discharging BA transport water, FGD wastewater, or CRL to surface waters.

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 Racial or Ethnic Minority or Low-Income, Compared to the General Population

Distance from Plant	Total Population (Millions)[a]	Percent Low-Income	Percent African American (Non-Hispanic)	Percent American Indian/Alaska Native	Percent Asian	Percent Native Hawaiian/Pacific Islander	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
1 mile	0.05	13.1%	7.9%	0.8%	1.2%	0.0%	2.6%	7.0%
3 miles	0.59	12.7%	8.0%	0.7%	1.8%	0.1%	2.5%	6.8%
United States	328.0	13.7%	12.2%	0.7%	5.4%	0.2%	2.7%	18.8%

Source: U.S. EPA Analysis, 2023

Notes:

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

Table 2. Number of Affected Communities Living within 1 and 3 Miles of a Steam Electric Power Plant and Associated Immediate Receiving Reach That Have a Higher Proportion of Individuals Who Identify as a Racial or Ethnic Minority or Low-Income than the National Average

Distance from Plant	Number of Plants[b]	Number of Communities[a] Living in Proximity to Steam Electric Power Plants That Have a Higher Proportion of a/an…						
		Low-Income Population	African American (Non-Hispanic) Population	Asian Population	Native Hawaiian/Pacific Islander Population	American Indian/Alaska Native Population	Other (Non-Hispanic) Population	Hispanic/Latino Population
		… than the National Average						
1 mile	92	35	16	19	2	4	35	4
3 miles	92	34	19	14	1	9	30	5
United States		13.7%	12.2%	0.7%	5.4%	0.2%	2.7%	18.8%

Source: U.S. EPA Analysis, 2023

Notes:

a-In this analysis, a "community" consists of the CBGs within the specified distance of each of the 92 steam electric power plants discharging BA transport water, FGD wastewater, or CRL to surface waters. For both buffer distances, around 2 percent of CBGs fall within the buffer area around multiple steam electric plants.

b-Includes all steam electric plants with non-zero pollutant loadings modeled under the baseline or regulatory options.

Table 3. Number of Affected Communities Living Within 1 and 3 Miles of a Steam Electric Power Plant and Associated Immediate Receiving Reach with a Higher Proportion of Individuals Identifying as a Racial or Ethnic Minority or Low-Income than Their State Average

Distance from Plant	Number of Plants	Number of Communities[a] Living in Proximity to Steam Electric Power Plants That Have a Higher Proportion of a/an…						
		Low-Income Population	African American (Non-Hispanic) Population	Asian Population	Native Hawaiian/Pacific Islander Population	American Indian/Alaska Native Population	Other (Non-Hispanic) Population	Hispanic/Latino Population
… than the State Average (b)								
1 mile	92	30	15	21	9	5	38	13
3 miles	92	35	13	19	20	18	40	18

Source: U.S. EPA Analysis, 2023.

Notes:

a-In this analysis, a “community” consists of the CBGs within the specified distance of each of the 92 steam electric power plants discharging BA transport water, FGD wastewater, or CRL to surface waters. For both buffer distances, around two percent of CBGs fall within the buffer area around multiple steam electric plants.

b-The state average is based on the states intersected by the analysis region around each steam electric power plant. In cases where an analysis region intersects multiple states, EPA weighted state statistics based on each state’s share of the total population within the analysis region.

Table 4. Socioeconomic Characteristics of the Populations of States with Communities Potentially Affected by Steam Electric Plant Discharges, Compared to the National Average

State	Socioeconomic Characteristics of Populations in Service Areas of Affected PWS						
	Percent Below Poverty Level	Percent African-American (Non-Hispanic)	Percent American Indian/Alaska Native (Non-Hispanic)	Percent Asian (Non-Hispanic)	Percent Native Hawaiian/Pacific Islander (Non-Hispanic)	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
AL	16.7%	26.5%	0.5%	1.3%	0.0%	1.9%	4.3%
AZ	15.1%	4.2%	3.9%	3.2%	0.2%	2.4%	31.3%
CA	13.4%	5.5%	0.4%	14.3%	0.4%	3.3%	39.0%
DC	16.2%	45.4%	0.2%	3.9%	0.0%	2.8%	11.0%
DE	11.8%	21.7%	0.3%	3.8%	0.0%	2.6%	9.2%
GA	15.1%	31.2%	0.2%	3.9%	0.0%	2.4%	9.5%
IA	11.5%	3.6%	0.3%	2.4%	0.1%	1.9%	6.0%
IL	12.5%	14.0%	0.1%	5.4%	0.0%	2.0%	17.1%
IN	13.4%	9.2%	0.2%	2.3%	0.0%	2.3%	6.9%
KS	12.0%	5.7%	0.7%	2.9%	0.1%	2.9%	11.9%
KY	17.3%	8.0%	0.2%	1.5%	0.1%	2.1%	3.7%
LA	19.2%	32.0%	0.5%	1.7%	0.0%	2.0%	5.1%
MA	10.3%	6.9%	0.1%	6.6%	0.0%	3.0%	11.8%
MD	9.2%	29.4%	0.2%	6.2%	0.0%	3.2%	10.1%
MN	9.7%	6.3%	0.9%	4.8%	0.0%	2.7%	5.4%
MO	13.7%	11.4%	0.4%	2.0%	0.1%	2.5%	4.2%
MS	20.3%	37.6%	0.4%	1.0%	0.0%	1.3%	3.1%
NC	14.7%	21.1%	1.1%	2.8%	0.1%	2.5%	9.4%
ND	10.7%	2.9%	5.1%	1.4%	0.1%	2.3%	3.7%
NE	11.1%	4.7%	0.8%	2.4%	0.1%	2.3%	10.9%
NH	7.6%	1.4%	0.1%	2.7%	0.0%	1.9%	3.7%
NV	13.1%	8.7%	0.9%	8.0%	0.6%	3.8%	28.7%
OH	14.0%	12.2%	0.1%	2.2%	0.0%	2.7%	3.8%
OK	15.7%	7.1%	7.3%	2.1%	0.1%	7.1%	10.6%
PA	12.4%	10.7%	0.1%	3.4%	0.0%	2.1%	7.3%
SC	15.2%	26.6%	0.3%	1.6%	0.1%	2.2%	5.7%
SD	13.1%	2.0%	8.4%	1.4%	0.1%	2.4%	3.8%
TN	15.2%	16.6%	0.2%	1.7%	0.1%	2.1%	5.4%

Table 4. Socioeconomic Characteristics of the Populations of States with Communities Potentially Affected by Steam Electric Plant Discharges, Compared to the National Average

State	Socioeconomic Characteristics of Populations in Service Areas of Affected PWS						
	Percent Below Poverty Level	Percent African-American (Non-Hispanic)	Percent American Indian/Alaska Native (Non-Hispanic)	Percent Asian (Non-Hispanic)	Percent Native Hawaiian/Pacific Islander (Non-Hispanic)	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
VA	10.6%	18.8%	0.2%	6.3%	0.1%	3.4%	9.4%
WV	17.6%	3.6%	0.2%	0.8%	0.0%	1.8%	1.6%
United States	13.7%	12.2%	0.7%	5.4%	0.2%	2.7%	18.8%

Source: *U.S. EPA Analysis, 2023*.

6.2 Socioeconomic Characteristics of Populations Served by Affected Drinking Water Systems

In addition 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.

As with the proximity analysis for communities near steam electric power plants, EPA began by collecting 2015 to 2019 population-specific ACS data from the U.S. Census Bureau (2022a) on:

- The percent of the population below the poverty threshold,[11] referred to as "low-income population" for this analysis.
- The population categorized in various racial/ethnic minority groups[12].

EPA conducted the analysis at the Zip Code Tabulation Area (ZCTA) level[13] and compared the socioeconomic characteristics of the affected ZCTAs (based on the service areas of affected PWS) to those of the state containing each ZCTA (U.S. Census Bureau, 2022b). PEJC may exist in areas where the percent of the population that is low-income and/or minority (including specific racial or ethnic categories) is higher than the respective state average.

Table 5 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.

11. 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.

12. 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 minority 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.

13. Information on zip codes served for each system was used to approximate a system's service area: EPA determined ZCTA boundaries to provide a more accurate approximation than boundaries at other geographic scales (*e.g.,* counties) in the absence of data on actual service areas boundaries for the affected systems. EPA is now working to collect information on actual service area boundaries for systems that could be used to better estimate the affected populations. See the 2023 BCA for more information.

Table 5. 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 American Indian/Alaska Native (Non-Hispanic)	Percent Asian (Non-Hispanic)	Percent Native Hawaiian/Pacific Islander (Non-Hispanic)	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
AL	81	2,008,103	16.6%	23.2%	0.5%	1.4%	0.1%	2.3%	5.7%
AZ	9	14,815	15.9%	2.9%	34.6%	0.8%	0.2%	1.9%	22.1%
CA	96	12,191,421	13.4%	6.4%	0.2%	14.9%	0.3%	2.8%	43.3%
DC	2	632,323	14.3%	39.5%	0.2%	5.4%	0.1%	3.0%	9.9%
DE	1	208,875	11.5%	24.8%	0.2%	5.9%	0.0%	2.7%	13.3%
GA	14	643,252	20.1%	39.3%	0.3%	1.3%	0.0%	2.3%	8.8%
IA	3	159,823	13.4%	7.5%	0.2%	2.8%	0.0%	2.9%	6.5%
IL	31	549,576	14.5%	16.8%	0.2%	1.6%	0.0%	2.4%	6.1%
IN	5	200,792	34.3%	33.5%	0.4%	0.1%	1.0%	4.4%	4.9%
KS	12	168,609	10.9%	7.2%	0.7%	1.3%	0.0%	3.1%	10.5%
KY	38	349,733	18.4%	5.4%	0.1%	0.6%	0.0%	1.9%	4.5%
LA	18	968,256	18.7%	40.0%	0.3%	3.2%	0.0%	2.0%	9.9%
MA	10	358,066	13.3%	3.8%	0.2%	9.5%	0.0%	1.9%	29.0%
MD	19	3,936,765	10.9%	39.0%	0.2%	8.0%	0.1%	3.2%	12.0%
MN	9	667,615	15.4%	15.8%	0.8%	5.4%	0.0%	3.9%	8.3%
MO	19	1,824,039	10.7%	23.0%	0.1%	3.7%	0.0%	2.5%	3.0%
MS	1	1,422	17.4%	2.5%	0.3%	0.0%	0.0%	0.6%	3.8%
NC	37	1,337,529	13.6%	57.9%	0.1%	2.0%	0.0%	2.5%	7.5%
ND	11	33,052	7.6%	1.3%	3.3%	0.7%	0.0%	2.1%	3.2%
NE	9	13,097	8.1%	0.8%	0.1%	0.2%	0.1%	1.2%	2.7%
NH	1	87,932	10.8%	3.0%	0.1%	7.6%	0.0%	2.9%	15.1%
NV	8	2,174,286	14.4%	11.2%	0.4%	9.0%	0.6%	4.0%	32.5%
OH	19	109,283	23.4%	6.1%	0.3%	1.0%	0.0%	2.9%	2.4%
OK	20	33,187	22.2%	1.1%	31.0%	0.8%	0.2%	9.6%	6.3%
PA	68	3,598,707	12.0%	11.9%	0.1%	3.9%	0.0%	2.5%	5.7%
SC	43	473,094	13.0%	22.6%	0.5%	1.5%	0.1%	2.6%	4.8%
SD	98	135,807	14.9%	1.0%	11.1%	1.9%	0.1%	2.1%	3.6%

Table 5. 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 American Indian/Alaska Native (Non-Hispanic)	Percent Asian (Non-Hispanic)	Percent Native Hawaiian/Pacific Islander (Non-Hispanic)	Percent Other (Non-Hispanic)	Percent Hispanic/Latino
TN	43	2,113,168	12.4%	16.6%	0.2%	2.7%	0.1%	2.6%	7.5%
VA	35	3,090,649	7.5%	15.7%	0.2%	12.4%	0.1%	4.2%	14.5%
WV	21	256,821	19.6%	3.9%	0.1%	2.1%	0.0%	2.9%	2.3%
AL	81	2,008,103	16.6%	23.2%	0.5%	1.4%	0.1%	2.3%	5.7%
AZ	9	14,815	15.9%	2.9%	34.6%	0.8%	0.2%	1.9%	22.1%
CA	96	12,191,421	13.4%	6.4%	0.2%	14.9%	0.3%	2.8%	43.3%
DC	2	632,323	14.3%	39.5%	0.2%	5.4%	0.1%	3.0%	9.9%
DE	1	208,875	11.5%	24.8%	0.2%	5.9%	0.0%	2.7%	13.3%
GA	14	643,252	20.1%	39.3%	0.3%	1.3%	0.0%	2.3%	8.8%
Total	**781**	**38,340,097**							
United States			**13.7%**	**12.2%**	**0.7%**	**5.4%**	**0.2%**	**2.7%**	**18.8%**

Source: U.S. EPA Analysis, 2023.

Notes:

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

As Table 5 shows, more than four million people, across over 2,000 ZCTAs and 36 states, are served by PWSs potentially affected by the estimated changes in source water quality under the regulatory options. Most of the 36 states with affected PWS serve ZCTAs with higher proportions of low-income, American Indian or Alaska Native (non-Hispanic), Native Hawaiian or Pacific Islander (non-Hispanic), Other (non-Hispanic) populations than the national average. Additionally, 25 percent of states with affected PWSs serve ZCTAs with higher proportions of Hispanic or Latino populations than the national average.

Table 6 and Table 7 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 compares the socioeconomic characteristics of the affected tribal areas to the relevant state averages as well as the national average.

Table 6. Percent of the Population in Tribal Areas with an Affected PWS Identifying as Low-Income Compared to Their Respective State Average and the 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
Crow Creek Reservation	SD	1,357	2,176	870,638	36.5%	13.1%
Lake Traverse Reservation	ND, SD	230	11,095	1,627,355	21.4%	12.0%
Lower Brule Reservation	SD	2,116(b)(c)	1,689	870,638	38.0%	13.1%
Navajo Nation	AZ, NM, UT	1,190	172,813	5,189,302	38.7%	13.5%
Otoe-Missouria	OK	250	880	3,932,870	15.9%	15.7%
Pine Ridge Reservation	NE, SD	8	19,950	2,785,209	45.3%	11.7%
Rosebud Indian Reservation	SD	9	11,404	870,638	58.7%	13.1%
Standing Rock Reservation	ND, SD	6,839	8,553	1,627,355	41.3%	12.0%
Yankton Reservation	SD	1,064	6,824	870,638	22.9%	13.1%
United States					13.7%	

Source: *U.S. EPA Analysis, 2023*.

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.

b-PWS ID 84690026 serves several reservations and counties. EPA distributed the SDWIS-reported population served equally over the three reservations served: Lower Brule Reservation, Pine Ridge Reservation, and Rosebud Indian Reservation.

c-PWS ID 84690441 serves the Lower Brule Reservation and surrounding South Dakota counties. As a result, the SDWIS-reported population served exceeds the Census-reported total population of the reservation. The affected percentage of tribal area was adjusted to 80 percent to reflect the fact that the majority of the reservation is likely served by the affected PWS.

Table 7. Percent of Population in Tribal Areas with an Affected PWS Identifying as a Racial or Ethnic Minority Compared to Their Respective State Average and the National Average

Tribal Area	States	Total Population			Percent African American (Non-Hispanic)		Percent American Indian/Alaska Native		Percent Asian		Percent Native Hawaiian/ Pacific Islander		Percent Other (Non-Hispanic)		Percent Hispanic/Latino	
		Affected Population[a]	Tribal Area	State(s) Population	Tribal	State Average (Avg.)	Tribal	State Avg.	Tribal	State Avg.	Tribal	State Avg.	Tribal	State Avg.	Tribal	State Avg.
Crow Creek Reservation	SD	1,357	2,176	870,638	1.6%	2.0%	85.0%	8.4%	0.0%	1.4%	0.0%	0.1%	1.0%	2.4%	4.6%	3.8%
Lake Traverse Reservation	ND, SD	230	11,095	1,627,355	0.6%	2.4%	40.2%	6.9%	0.0%	1.4%	0.0%	0.1%	2.4%	2.3%	4.9%	3.8%
Lower Brule Reservation	SD	2,116[b,c]	1,689	870,638	0.2%	2.0%	90.6%	8.4%	0.4%	1.4%	0.2%	0.1%	0.9%	2.4%	1.4%	3.8%
Navajo Nation	AZ, NM, UT	1,190	172,813	5,189,302	0.2%	1.4%	95.2%	4.1%	0.3%	2.0%	0.1%	0.5%	1.0%	2.2%	1.7%	28.1%
Otoe-Missouria	OK	250	880	3,932,870	0.3%	7.1%	32.8%	7.3%	0.5%	2.1%	0.2%	0.1%	14.2%	7.1%	9.8%	10.6%
Pine Ridge Reservation	NE, SD	8	19,950	2,785,209	0.1%	3.8%	83.7%	3.2%	0.1%	2.1%	0.0%	0.1%	1.8%	2.3%	3.5%	8.7%
Rosebud Indian Reservation	SD	9	11,404	870,638	0.1%	2.0%	88.1%	8.4%	1.7%	1.4%	0.0%	0.1%	1.4%	2.4%	1.2%	3.8%
Standing Rock Reservation	ND, SD	6,839	8,553	1,627,355	0.2%	2.4%	74.7%	6.9%	0.0%	1.4%	0.0%	0.1%	1.7%	2.3%	2.6%	3.8%
Yankton Reservation	SD	1,064	6,824	870,638	0.1%	2.0%	39.4%	8.4%	0.2%	1.4%	0.1%	0.1%	5.6%	2.4%	4.9%	3.8%
United States					12.2%		0.7%		5.4%		0.2%		2.7%		18.8%	

Source: U.S. EPA Analysis, 2023.

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.

b-PWS ID 84690026 serves several reservations and counties. EPA distributed the SDWIS-reported population served equally over the three reservations served: Lower Brule Reservation, Pine Ridge Reservation, and Rosebud Indian Reservation.

c-PWS ID 84690441 serves the Lower Brule Reservation and surrounding South Dakota counties. As a result, the SDWIS-reported population served exceeds the Census-reported total population of the reservation. The affected percentage of tribal area was adjusted to 80 percent to reflect that the majority of the reservation is likely served by the affected PWS.

As shown in Table 6, affected tribal areas consistently have higher proportions of people who are below the poverty level compared to both state and national averages. As shown in Table 7, 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 Otoe-Missouria tribal area has twice the proportion of people who identify as “Other (non-Hispanic)” than the state average and over five times the national average.

6.3 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[14] of reaches of affected by steam electric plant discharges, including both reaches that receive discharges from steam electric power plants and downstream reaches.[15] To assess the socioeconomic characteristics of these communities, EPA collected 2015 to 2019 population-specific ACS data (U.S. Census Bureau, 2022a) on:

- The percent of the population below the poverty threshold,[16] referred to as “low-income population” in this analysis.
- The population categorized in various racial/ethnic minority groups.[17]

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

EPA conducted this analysis for communities affected by changes in pollutant loadings under two periods (Period 1[18] and Period 2[19]). Given that the results of the proximity analysis show similar water quality improvement and distributions in socioeconomic characteristics among affected communities between Period 1 and Period 2, with only differences in magnitude, results are only presented and discussed for Period 2 (Table 8-Table 10).[20]

14. See the 2023 BCA for an explanation of why a 50-mile radius was used to estimate the potentially affected population.

15. 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 121.1 million people as of 2019. This analysis provides total population and does not make adjustments for the fraction of this population that consumes self-caught fish.

16. 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.

17. 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 minority 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.

18. 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 (2023 BCA).

19. Period 2 covers the years 2030 through 2049: the post-transition period during which the full universe of plants is projected to employ treatment practices that achieve the revised limitations.

20. Results for Period 1 can be found in Appendix A.

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 Compared to the National Average (Period 2)

Pollutant	Changes in Concentrations	Number of Downstream Reaches[a]				Percent Low-Income Population			
		Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4
Antimony	Decreases[b]	87	3,423	6,885	7,339	6.3%	15.2%	16.1%	16.2%
	No changes	9226	5,890	2,428	1,974	16.1%	15.8%	14.6%	14.2%
Arsenic	Decreases	7,136	7,869	9,147	9,313	14.8%	15.5%	15.4%	15.6%
	No changes	2,177	1,444	166	0	19.5%	16.2%	32.8%	0.0%
Cadmium	Decreases	7,136	7,869	9,147	9,313	14.8%	15.5%	15.4%	15.6%
	No changes	2,177	1,444	166	0	19.5%	16.2%	32.8%	0.0%
Cyanide[a]	Decreases	0	3,336	3,336	4,237	0.0%	16.5%	16.5%	18.3%
	No changes	4237	901	901	0	18.3%	26.5%	26.5%	0.0%
Lead[a]	Decreases	87	3,423	6,885	7,339	6.3%	15.1%	15.9%	16.0%
	No changes	7266	3,930	468	14	16.8%	17.2%	18.4%	6.1%
Manganese	Decreases	87	3,423	6,885	7,339	6.3%	15.2%	16.1%	16.2%
	No changes	9226	5,890	2,428	1,974	16.1%	15.8%	14.6%	14.2%
Mercury	Decreases	7,136	7,869	9,147	9,313	14.8%	15.5%	15.4%	15.6%
	No changes	2,177	1,444	166	0	19.5%	16.2%	32.8%	0.0%
Thallium	Decreases	87	3,423	6,885	7,339	6.3%	15.2%	16.1%	16.2%
	No changes	9226	5,890	2,428	1,974	16.1%	15.8%	14.6%	14.2%
United States						**13.7%**			

Source: U.S. EPA Analysis, 2023.

Notes:

a-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 (4,237 and 7,353 reaches for cyanide and lead, respectively, compared to 9,313 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 2.4347 mg/L. Given the small range of pollutant changes observed–zero mg/L to -2.4347 mg/L–, EPA generalized these changes as "decreases" for each pollutant for ease of comprehension.

Table 9. 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 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4
Antimony	Decreases[b]	87	3,423	6,885	7,339	0.1%	0.3%	0.6%	0.6%	6.8%	3.6%	3.8%	3.7%	0.0%	0.0%	0.1%	0.1%
	No changes	9226	5,890	2,428	1,974	0.5%	0.6%	0.3%	0.3%	3.5%	3.7%	3.5%	3.6%	0.1%	0.1%	0.1%	0.1%
Arsenic	Decreases	7,136	7,869	9,147	9,313	0.3%	0.3%	0.5%	0.5%	3.7%	3.8%	3.7%	3.7%	0.1%	0.1%	0.1%	0.1%
	No changes	2,177	1,444	166	0	1.5%	3.4%	0.2%	0.0%	3.3%	1.8%	1.3%	0.0%	0.1%	0.1%	0.0%	0.0%
Cadmium	Decreases	7,136	7,869	9,147	9,313	0.3%	0.3%	0.5%	0.5%	3.7%	3.8%	3.7%	3.7%	0.1%	0.1%	0.1%	0.1%
	No changes	2,177	1,444	166	0	1.5%	3.4%	0.2%	0.0%	3.3%	1.8%	1.3%	0.0%	0.1%	0.1%	0.0%	0.0%
Cyanide[a]	Decreases	0	3,336	3,336	4,237	0.0%	0.3%	0.3%	0.3%	0.0%	3.2%	3.2%	3.0%	0.0%	0.0%	0.0%	0.0%
	No changes	4,237	901	901	0	0.3%	0.3%	0.3%	0.0%	3.0%	2.3%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Lead[a]	Decreases	87	3,423	6,885	7,339	0.1%	0.3%	0.6%	0.5%	6.8%	3.8%	3.9%	3.8%	0.0%	0.0%	0.1%	0.1%
	No changes	7,266	3,930	468	14	0.6%	0.9%	0.2%	0.5%	3.5%	3.8%	2.0%	2.9%	0.1%	0.1%	0.1%	0.1%
Manganese	Decreases	87	3,423	6,885	7,339	0.1%	0.3%	0.6%	0.6%	6.8%	3.6%	3.8%	3.7%	0.0%	0.0%	0.1%	0.1%
	No changes	9,226	5,890	2,428	1,974	0.5%	0.6%	0.3%	0.3%	3.5%	3.7%	3.5%	3.6%	0.1%	0.1%	0.1%	0.1%
Mercury	Decreases	7,136	7,869	9,147	9,313	0.3%	0.3%	0.5%	0.5%	3.7%	3.8%	3.7%	3.7%	0.1%	0.1%	0.1%	0.1%
	No changes	2,177	1,444	166	0	1.5%	3.4%	0.2%	0.0%	3.3%	1.8%	1.3%	0.0%	0.1%	0.1%	0.0%	0.0%
Thallium	Decreases	87	3,423	6,885	7,339	0.1%	0.3%	0.6%	0.6%	6.8%	3.6%	3.8%	3.7%	0.0%	0.0%	0.1%	0.1%
	No changes	9,226	5,890	2,428	1,974	0.5%	0.6%	0.3%	0.3%	3.5%	3.7%	3.5%	3.6%	0.1%	0.1%	0.1%	0.1%
United States						12.2%				0.7%				5.4%			

Source: U.S. EPA Analysis, 2023.

Notes:

a-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 (4,237 and 7,353 reaches for cyanide and lead, respectively, compared to 9,313 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 2.4347 mg/L. Given the small range of pollutant changes observed– zero mg/L to -2.4347 mg/L–, EPA generalized these changes as “decreases” for each pollutant for ease of comprehension.

Table 10. 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 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4
Antimony	Decreases[b]	87	3,423	6,885	7,339	2.7%	2.3%	2.5%	2.5%	10.2%	12.1%	10.6%	10.4%	9.3%	13.6%	13.2%	13.2%
	No changes	9,226	5,890	2,428	1,974	2.5%	2.6%	2.4%	2.4%	10.6%	9.6%	10.4%	10.8%	13.5%	13.1%	13.6%	13.5%
Arsenic	Decreases	7,136	7,869	9,147	9,313	2.5%	2.4%	2.5%	2.5%	9.3%	10.8%	10.6%	10.5%	13.0%	13.1%	13.3%	13.3%
	No changes	2,177	1,444	166	0	2.6%	3.2%	1.5%	0.0%	17.2%	7.1%	3.6%	0.0%	15.0%	16.1%	16.8%	0.0%
Cadmium	Decreases	7,136	7,869	9,147	9,313	2.5%	2.4%	2.5%	2.5%	9.3%	10.8%	10.6%	10.5%	13.0%	13.1%	13.3%	13.3%
	No changes	2,177	1,444	166	0	2.6%	3.2%	1.5%	0.0%	17.2%	7.1%	3.6%	0.0%	15.0%	16.1%	16.8%	0.0%
Cyanide[a]	Decreases	0	3,336	3,336	4,237	0.0%	2.2%	2.2%	2.2%	0.0%	12.8%	12.8%	11.8%	0.0%	14.4%	14.4%	14.5%
	No changes	4,237	901	901	0	2.2%	2.3%	2.3%	0.0%	11.8%	7.2%	7.2%	0.0%	14.5%	15.1%	15.1%	0.0%
Lead[a]	Decreases	87	3,423	6,885	7,339	2.7%	2.3%	2.5%	2.5%	10.2%	13.0%	11.2%	10.9%	9.3%	13.6%	13.2%	13.2%
	No changes	7,266	3,930	468	14	2.5%	2.8%	2.2%	2.6%	11.0%	8.0%	5.9%	10.1%	13.5%	12.6%	14.2%	10.9%
Manganese	Decreases	87	3,423	6,885	7,339	2.7%	2.3%	2.5%	2.5%	10.2%	12.1%	10.6%	10.4%	9.3%	13.6%	13.2%	13.2%
	No changes	9,226	5,890	2,428	1,974	2.5%	2.6%	2.4%	2.4%	10.6%	9.6%	10.4%	10.8%	13.5%	13.1%	13.6%	13.5%
Mercury	Decreases	7,136	7,869	9,147	9,313	2.5%	2.4%	2.5%	2.5%	9.3%	10.8%	10.6%	10.5%	13.0%	13.1%	13.3%	13.3%
	No changes	2,177	1,444	166	0	2.6%	3.2%	1.5%	0.0%	17.2%	7.1%	3.6%	0.0%	15.0%	16.1%	16.8%	0.0%
Thallium	Decreases	87	3,423	6,885	7,339	2.7%	2.3%	2.5%	2.5%	10.2%	12.1%	10.6%	10.4%	9.3%	13.6%	13.2%	13.2%
	No changes	9,226	5,890	2,428	1,974	2.5%	2.6%	2.4%	2.4%	10.6%	9.6%	10.4%	10.8%	13.5%	13.1%	13.6%	13.5%
United States						0.2%				2.7%				18.8%			

Source: U.S. EPA Analysis, 2023.

Notes:

a-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 (4,237 and 7,353 reaches for cyanide and lead, respectively, compared to 9,313 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 2.4347 mg/L. Given the small range of pollutant changes observed–zero mg/L to -2.4347 mg/L–, EPA generalized these changes as "decreases" for each pollutant for ease of comprehension.

As shown in Table 8, communities living near the majority of reaches (regardless of the associated water quality change under the regulatory options) have a larger proportion of low-income population than the national average. As shown in Table 9 and Table 10, all of the reaches (regardless of the associated water quality change under the regulatory options) have:

- A smaller proportion of people who identify as Black or African American (non-Hispanic), people who identify as Asian (non-Hispanic), and people who identify as Hispanic or Latino than national averages.
- A larger proportion of 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 Other (non-Hispanic) than national averages.

6.4 Key Conclusions

The results of EPA's power plant proximity analysis indicates that, similar to the findings of the literature review, steam electric power plants are disproportionately 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 population groups of concern (American Indian or Alaska Native [non-Hispanic], Native Hawaiian or Pacific Islander [non-Hispanic], and Hispanic or Latino) than the average community when compared to state averages. Accounting for the differences when comparing to the national average, EPA concludes that while communities living in proximity to steam electric power plants may have smaller total populations on average, they tend to have larger proportions of population groups of concern.

Additionally, the PWS and downstream proximity analyses indicate that, like the literature review suggests, population groups of concern may experience disproportionate impacts from pollutants discharged by steam electric power plants. The PWS analysis shows that populations served by potentially affected PWSs have larger proportions of population groups of concern (American Indian or Alaska Native [non-Hispanic], Native Hawaiian or Pacific Islander [non-Hispanic], Other [non-Hispanic], and Hispanic or Latino) than the average community in the United States. Focusing on PWSs serving tribal areas, PWSs were found to serve areas with larger proportions of population groups of concern (low-income and racial and ethnic minorities other than American Indian or Alaska Native [non-Hispanic]) than the average community in the 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 population groups of concern (low-income, American Indian or Alaska Native [non-Hispanic], Native Hawaiian or Pacific Islander [non-Hispanic], and Other [non-Hispanic]) than the average community in the United States.

7. Engagement with Communities with Potential Environmental Justice Concerns

As part of the EJ analysis, EPA conducted initial outreach with a subset of affected communities identified as having PEJC due to their socioeconomic and environmental characteristics. In some communities, this outreach led to public meetings. The purpose of the meetings was to begin communicating with local communities, inform communities of the proposed regulatory action, and get their input on their preferences for regulatory requirements for steam electric power plants. Additionally, EPA used the public meetings to collect information on environmental and socioeconomic impacts and concerns in communities to improve its analyses of distributional impacts of the proposed rule.

This section discusses, the process by which EPA identified and chose communities with PEJC for initial outreach, the approach the Agency used to plan the meetings, and the input received at the meetings.

7.1 Evaluating PEJC in Communities Affected by the Proposed Rule

EPA performed a set of screening analyses to identify the environmental and socioeconomic characteristics of all the communities that are expected to be affected via relevant exposure pathways by steam electric power plants within the scope of the proposed rule. For these analyses, steam electric power plants were considered in-scope if they were identified as having a retirement date after 2023 (including those with no announced retirement date) and costs for FGD wastewater, BA transport water, and/or CRL. The exposure pathways analyzed in the screening analyses were air, surface water, and drinking water. EPA used the Office of Water's EJSCREENBatch tool for the screening analyses (U.S. EPA, 2022b). The tool was chosen because it can perform batch screening analyses for multiple locations at once, improving the efficiency of the nationwide screening analysis. It also enables users to perform screening analyses around surface waters and other features that cannot be directly accommodated by EPA's Environmental Justice Screening and Mapping Tool (EJScreen) itself (U.S. EPA, 2019a).

EPA's specific approach in using EJSCREENBatch for each exposure pathway is discussed below.

7.1.1 Air Screening Analysis

EPA selected one- and three-mile buffers around the facility GIS coordinates as the appropriate distance for screening the air pathway. These distances were chosen to be consistent with the buffer distances the Office of Air and Radiation uses when performing screening analyses for communities surrounding industrial sources that are expected to be exposed to air emissions (U.S. EPA, 2021a). These are the distances at which air pollution concentrations will be highest before the plume disperses. For each steam electric power plant, EPA used the EJSCREENBatch tool to draw one- and three-mile buffers, generating aggregate raw values and state and national percentile values at each buffer distance for relevant demographic and environmental indicators. Automatically generated correlation plots and box plots with the state and national percentile results at each buffer distance are presented in Appendix B, Section 1, to facilitate visualization of these data.

7.1.2 Downstream Surface Water Screening Analysis

EPA chose buffer distances of one-, three-, 50-, and 100-miles around the downstream waterbody segment, defined as 300 kilometers (about 187 miles) downstream of the initial common identifiers (COMIDs) identified for each effluent discharge (USGS, 2022; U.S. EPA, 2022c). The downstream distance of 300 kilometers was chosen to correspond with the downstream distance used in the Downstream Fate and Transport Equations (D-FATE) model. This model is used to estimate the concentrations of pollutants in downstream reaches of receiving waters of steam electric power plants and serves as an input to the risk assessment of relevant health endpoints. The 50- and 100-mile buffers were used to account for potential exposures among individuals traveling to the waterbodies to recreate or engage in other activities; the one- and three-mile buffers were used based on recommended buffer distances for screening analyses (U.S. EPA, 2019a). Aggregate raw values and state and national percentile values for the demographic and environmental indicators were then retrieved for each COMID within the defined areas. Automatically generated correlation plots and box plots with the state and national percentile results at each buffer distance are presented in Appendix B, Section 2, to facilitate visualization of these data.

7.1.3 Drinking Water Screening Analysis

EPA selected public water system IDs (PWSIDs) for drinking water systems intaking water from receiving waters of in-scope steam electric power plants, associated zip codes from EPA's Fourth Unregulated Contaminant Monitoring Rule (UCMR4) and Safe Drinking Water Information System (SDWIS) datasets, and 2019 ZCTAs from the U.S. Census Bureau's TIGER/Line shapefiles (U.S. EPA, 2021b; U.S. EPA, 2022d; U.S. Census Bureau, 2022b). Zip code information from UCMR4 and SDWIS was used to estimate the service area boundaries for each of the PWSIDs in the absence of a complete dataset of actual service area boundaries for all PWS.[21]

Before the analysis was run in the EJSCREENBatch tool, EPA used ArcGIS to merge the dataset of the PWSIDs and associated zip codes served with the shapefile dataset of the 2019 ZCTAs.[22] This created one dataset in which the zip code(s) served for each system were listed along with the zip code boundaries. For those systems with multiple zip codes served, EPA used ArcGIS to dissolve the boundaries of the individual zip codes into one large boundary. This simplified the analysis: when the dataset was run through the tool, for the systems with multiple zip codes served, the tool generated aggregate indicator results for one area rather than several small areas.

The screening analysis was performed using the EJSCREENBatch tool to draw the service area polygons with a buffer distance of 0.01 miles, as the tool does not allow users to set a buffer distance of zero miles. This, in effect, draws the service area polygon 0.01 miles outside the actual ZCTA-estimated service area. Automatically generated correlation plots and box plots with the state and national percentile results at each buffer distance are presented in Appendix B, Section 3, to facilitate visualization of these data.

7.2 Identifying Communities with PEJC

After completing the screening analyses, EPA used the results[23] to inform the selection of a subset of communities with PEJC that would be prioritized for initial outreach and engagement. EPA defined a community as having PEJC if its indicator results met one or more of the following indicator criteria:

21. The UCMR4 dataset was the primary source used for identifying zip code(s) served for each PWSID. The UCMR4 collected information from all large systems and a random sample of 800 small systems on the zip code(s) those systems served. For systems EPA identified that were not found in the UCMR4 dataset, the zip code reported for the system in the SDWIS dataset was used as the zip code served for that system. 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. Understanding this, EPA determined this method to be appropriate in the absence of data on the zip code(s) served for every system.

22. Additionally, the 2019 ZCTAs dataset was used to generate spatial boundaries for the zip code(s) served by each system. The zip code boundaries included in the 2019 ZCTAs dataset are approximate area representations of U.S. Postal Service (USPS) zip codes, so there is some error in the populations included under respective zip codes. Additionally, the U.S. Census Bureau cannot estimate ZCTAs for all USPS zip codes, so EPA could not analyze some systems as there were no ZCTA boundaries estimated for the zip code(s) they served. Understanding these limitations, EPA determined the 2019 ZCTAs dataset was an appropriate dataset to use for the analysis given the absence of a comprehensive zip code boundary dataset.

23. U.S. EPA, 2022b.

- Both demographic (minority and low-income) indicators and at least one environmental indicator above the 50th percentile nationally or all environmental indicators and at least one demographic indicator above the 50th percentile nationally.
- Two or more demographic and/or environmental indicators above the 80th percentile nationally.
- One or more demographic and/or environmental indicators above the 90th percentile nationally.
- One or more demographic and/or environmental indicators above the 95th percentile nationally.

Communities with indicator results that did not meet any of the indicator criteria were considered less likely to have PEJC and were not included in the tiering for initial community outreach and engagement. To avoid any bias that a single criterion might contain, EPA retained the communities that met one or more of the indicator criteria. However, to prioritize initial outreach and engagement, EPA then sorted these communities into tiers based on the number of indicators exceeded:

- Tier 1: A community's indicator results meet all four indicator criteria.
- Tier 2: A community's indicator results meet two or three indicator criteria.
- Tier 3: A community's indicator results meet one indicator criteria.

EPA considered communities sorted under Tier 1 to be the highest-priority communities for initial outreach and engagement.

In addition to the indicator criteria, EPA verified its results in two ways. First, EPA analyzed the aggregate raw indicator values and other outputs generated by the EJSCREENBatch tool to verify that communities with PEJC were not being omitted. Second, EPA looked at the top 10 power plants, downstream receiving waters, and PWSs with the most indicators over the 80th percentile nationally for each screening analysis. Comparing these results to those from EPA's indicator criteria approach shows that approach captured all top 10 facilities.

7.3 Choosing Communities for Initial Outreach

Because EPA could only meet with a subset of communities with PEJC during the proposal phase of the rulemaking process, the Agency prioritized meeting with communities that may be more likely to have PEJC.

EPA generated lists of Tier 1, Tier 2, and Tier 3 communities, 10 each, for a total of 30. Each list of communities was about evenly split between communities potentially affected by power plants, downstream surface waters, and drinking water systems, with three plants, four downstream surface waters (two from the one- and three-mile buffer screening and two from the 50- and 100-mile buffer screening), and three drinking water systems.

In choosing the subset of locations, EPA considered tiering results at every buffer distance. For the air screening analysis, there were no substantial differences in indicator criteria and tiering results for steam electric power plants between the one-mile and three-mile buffer distances used. Therefore, the subsets of steam electric power plants that EPA chose for each list were representative of areas with PEJC at both buffer distances. For the downstream surface water screening analysis, there were no substantial differences in indicator criteria and tiering results for surface waters between the one-mile and three-mile buffer distances, but there were substantial differences between the one- and three-mile results and the 50- and 100-mile results. Because of this, EPA accounted for both sets of results in its tier lists. For the drinking water screening analysis, this consideration was not relevant as only one buffer distance–0.01 miles-was used. EPA also considered geographic diversity, including various states and regions to ensure that community input would reflect nationwide variation in impacts and concerns among communities with PEJC.

EPA conducted initial outreach with nine communities. The Agency's first choice was the top three Tier 1 communities from each of the three screening analyses. For the surface water and drinking water screening analyses, though there were no Tier 1 communities were in scope. EPA instead chose the top Tier 2 communities or Tier 3 communities which EPA had engaged with prior to the decision to conduct the current rulemaking.

7.3.1 Communities Chosen for Initial Outreach

The final list of communities chosen for initial outreach is presented in Table 11. Communities that EPA engaged with prior to the initiation of the current rule are indicated by a "Yes" in the "Pre-Rule" column. EPA conducted initial outreach to local environmental and community development organizations, local government agencies, and individual community members involved in community organizing in all nine communities. Between May and September 2022, EPA was able to meet with five of the identified communities either virtually (indicated as "Virtual Meeting" in the "Proposal" column) or in a hybrid virtual and in-person format (indicated as "Hybrid Meeting" in the "Proposal" column). EPA has not been able to hold virtual or hybrid meetings with the remaining four communities (indicated as "Initial Outreach" in the Proposal column) because of difficulties in finding community representatives who could help with coordinating and planning an initial meeting; the Agency is continuing to consider whether and how to engage with these communities. EPA is also soliciting comment in the proposed rule on whether additional communities with identified PEJC should be included for future engagement.

Table 11. List of Affected Communities Chosen for Initial Public Meetings Based on the Results of EPA's Air, Surface Water, and Drinking Water Screening Analyses

#	Screening Result (Plant/Waterbody/PWS)	State	Screening Analysis	Tier	Pre-Rule	Proposal
1	EIA #667, Northside Generating Station	FL	Air	1		Virtual Meeting
2	EIA #3297, Wateree Station	SC	Air	1		Initial Outreach
3	EIA #2442, Four Corners Steam Electric Station	NM	Air	1	YES	Virtual Meeting
4	COMID 10161978, Ohio River (EIA#6071, Trimble County)	KY	Surface Water	2		Virtual Meeting
5	COMID 6499098, Etowah River (EIA# 703, Plant Bowen)	GA	Surface Water	2		Initial Outreach
6	COMID 3124250, Rabbs Bayou (EIA# 3470, W.A. Parish E.G.S.)	TX	Surface Water	2		Hybrid Meeting
7	PWSID 84690510, Standing Rock Rural Water System, Fort Yates (EIA# 2817, Leland Olds Station)	ND	Drinking Water	2		Initial Outreach
8	PWSID MI0001800, City of Detroit (EIA#6034, Belle River Power Plant and EIA#1733, Monroe Power Plant)	MI	Drinking Water	2		Initial Outreach
9	PWSID NC0279010, NC0279030, NC0279040, and NC3079031 Town of Eden, Town of Madison, Dan River Water Inc, Rockingham Co–220 Corridor (EIA# 8042, Belews Creek Steam Station)	NC	Drinking Water	3	YES	Hybrid Meeting

7.4 Approach to Community Outreach

In advance of the public meetings for this effort, EPA identified several best practices for its initial community outreach and engagement efforts. The sections below outline the process by which EPA planned and prepared for public meetings, integrating these best practices.

7.4.1 Establishing Connections with Community Representatives

EPA attempted to leverage its limited resources by identifying and partnering with community representatives who could organize meetings, host meetings (hybrid only), and reach out to community members to encourage participation. Additionally, EPA recognized the value in partnering with community representatives to alleviate community members' possible concerns about engaging directly with a government agency.

To identify leaders in each of the communities chosen for public meetings, EPA first contacted environmental organizations that had provided public comment on the 2020 rule, along with individuals recommended by EJ Coordinators for the EPA regions where the communities were located. For most of the communities, this approach yielded contact information for community representatives associated with local environmental and community development organizations and local government agencies, as well as individual community members involved in community organizing. For the remaining communities, EPA also reached out to state environmental agencies and used online research to gather contact information.

After collecting this information, EPA contacted and scheduled introductory calls with the community representatives to provide them with background on the proposed rule, explain why EPA had chosen their communities for initial outreach, and discuss the purpose of the potential meeting. After confirming that the community representatives could help EPA plan a meeting and act as community partners to elicit community participation, the Agency gathered information on the preferred meeting format, day of the week, time of day, amount of advance notice, and any additional resources that might be needed to ensure an accessible and beneficial meeting for community members. EPA then continued to meet with community representatives as needed after the initial call to continue planning the meetings and coordinating outreach materials.

7.4.2 Developing Outreach and Meeting Materials

EPA intended the public meetings to serve as opportunities for community members to learn about the proposed rule and to provide meaningful input on regulatory preferences and impacts and concerns related to steam electric power plants, along with input from other stakeholders, as it developed the proposed rule. Accordingly, EPA developed a set of outreach materials describing the meeting and its purpose, as well as the proposed rule.

One of these outreach materials was a one-page factsheet, provided to community members in advance of the meeting. The factsheet's purpose was to communicate the following information simply and concisely:

- What EPA, the ELG program, and the proposed rule are.
- The purpose of the meeting, general topics that would be discussed, and why their input mattered.
- How EPA would use the input, how the results of the analysis would be shared with the communities, and what additional plans the Agency had for continued engagement with them.
- Contact information for EPA points of contact on the proposed rule.

To ensure that the factsheet would be clear to people across a broad range of literacy levels within and among the communities selected for public meetings, EPA was mindful of using language at a fifth-grade reading level and made use of pictures to communicate information where feasible.

In addition to the factsheet, EPA developed a presentation that was given to community members at the beginning of each public meeting. The presentation expanded on the information included in the factsheet, particularly information about the ELG program and the rulemaking. EPA included it at the beginning of the meetings to ensure that all attendees had a baseline level of understanding about the scope of the rulemaking and the purpose of the meeting so that they would be better able to provide meaningful input. Additionally, the presentation gave community members the opportunity to ask EPA questions about the rulemaking, how their information would be used, and how EPA would continue engagement. This helped give transparency to the meetings that would be essential for creating an environment where community members felt comfortable providing the Agency with their input.

After drafting the factsheet and presentation, EPA sent them to the community representatives for review. Based on their feedback, EPA then revised the factsheet and presentation to improve the content and ease of comprehension. For example, based on input from community representatives in Texas, EPA provided English and Spanish versions of the factsheet and presentation to accommodate the Spanish-speaking population in that area.

The factsheet and presentation are presented in Appendix C.

7.4.3 Preparing for Discussions with Community Members

Before the community meetings, EPA held calls with community representatives as well as EPA regional staff and/or state government officials to discuss potential impacts or their concerns about the nearby steam electric power plants, affected downstream surface waters, or drinking water systems. Additionally, when available, EPA reviewed comments submitted as part of the permitting process for the relevant plants to understand pre-existing impacts or concerns identified by community members.

7.4.4 Designing and Scheduling Community Meetings

EPA understood that to ensure communities could provide meaningful input, meetings needed to be scheduled and held at a time and in a format that was convenient and accessible for community members. To achieve this, EPA remained flexible in its approach to when and how the meetings were held, allowing community representatives to guide the Agency's planning based on the specific needs in their communities.

In meetings with community representatives, EPA received feedback on the appropriate time of day and days of the week for the meetings to be held. For most of the communities EPA met with, evening meetings were the most convenient: many community members work during the day and also have childcare obligations that make morning and afternoon meetings difficult to attend. While preferred days of the week varied by community, most communities advised EPA against scheduling meetings on specific days of the week due to regularly scheduled religious or community activities.

EPA also received feedback from community representatives on the most accessible meeting formats for their communities. The most accessible meeting formats for most communities were either virtual (via a teleconferencing platform like Zoom or a conference call number) or hybrid, a combination in-person and virtual meeting. Whether a virtual or hybrid meeting was held depended on each community's specific needs, so EPA allocated resources during the planning process to build its capacity to host meetings in both formats. Often, hybrid meetings were preferred in communities that did not have widespread internet access and/or where community members felt more comfortable speaking with EPA in-person.

Additionally, EPA received input from community representatives about what resources they would need provided to host the meetings and whether translation services would be needed. The need for resources pertained mostly to the hybrid meetings, particularly with audio visual equipment, as venues chosen based on their location and accessibility were not always equipped for hybrid meetings. EPA worked closely with community representatives and its own contractors to identify and provide the needed audio-visual equipment. For the hybrid meetings, EPA contractors also traveled with Agency staff to provide on-site technical support. EPA also provided translation services when representatives indicated that languages other than English were predominantly spoken in their communities. Based on the community leaders' determinations, EPA provided in-person and virtual translation services for meetings on a case-by-case basis.

7.5 Results of the Public Meetings

EPA held the community meetings beginning in May 2022. Across the five meetings, the Agency met with a total of 80 community members. EPA followed a uniform structure for each meeting. Meetings began with introductions by EPA staff and community representatives, along with a brief tutorial from Agency contractors about how community members could participate, provide feedback, and resolve technical issues virtually and in-person. Then EPA gave a presentation, providing an overview of the ELG program, the proposed rule, and the purpose of the public meetings, after which the Agency answered questions from community members on the content covered. Once all questions were answered, EPA began the discussion portion of the meeting asking questions and soliciting input from community members on the following topics:

- Ideas and strategies for limiting pollution from steam electric power plants
- Concerns from community members related to steam electric power plants and other sources of pollution; nearby rivers, lakes, and streams; or their drinking water
- Community health, social or economic concerns.

The questions asked and the input received varied across communities based on the level of knowledge in the community about the steam electric power plants and water pollution from the plants, as well as the level of organization in the community around environmental issues. In meetings with communities where there was widespread knowledge about water pollution issues related to steam electric power plants and greater community organization around such issues, community members generally gave prepared statements to EPA with detailed accounts of pollution concerns, community impacts, and regulatory preferences. Meetings with communities with less knowledge about steam electric power plants and water pollution issues needed more facilitation by EPA. In these meetings, feedback from community members on pollution concerns and community impacts was less specific to plants and water pollution; community members generally asked more questions about the rulemaking and what pollution issues it could address, rather than having specific preferences for requirements to include in the proposed rule under development.

An overview of the input received by EPA from community members is presented below. Detailed records of the input received in each meeting can be found in Appendix D.

7.5.1 Regulatory Preferences

In the public meetings, community members shared their preferences on the stringency of the proposed rule under development, requirements for specific discharges from steam electric power plants, and additional requirements for steam electric power plants that could be incorporated into the proposed rule.

In general, community members communicated their support for more stringent requirements on wastewater discharges from steam electric power plants.

- In EPA's meeting with community members of the Navajo Nation, community participants stated that they supported the most stringent regulations on wastewater discharges from steam electric power plants. They recommended that EPA eliminate wastewater discharges–particularly BA transport water-from steam electric power plants and regulate all pollutants in these wastewater discharges through the proposed rule. They also expressed support for shorter compliance timeframes for steam electric power plants in the proposed rule, as an added measure to reduce wastewater discharges.

- In North Carolina and Kentucky, community participants recommended that EPA incorporate zero liquid discharge (ZLD) requirements for wastewater discharges into the proposed rule, with participants in Kentucky noting that this should be required for all wastestreams from steam electric power plants. Participants in North Carolina noted that EPA could recommend use of membrane technologies in the proposed rule as it would enable steam electric power plants to quickly comply with a ZLD requirement. Participants in Kentucky recommended that EPA eliminate a provision in the 2020 rule that allowed steam electric power plants to operate wet BA systems and purge 10 percent of transport water by volume on a rolling monthly basis.

In addition to preferences for regulating wastewater discharges from steam electric power plants, participants from across the communities that EPA met with expressed concerns about a lack of information-sharing from the steam electric power plants in their communities.

- Participants in Kentucky, Texas, and North Carolina expressed concerns with a lack of data from the plants on their discharges and the resultant pollutant loadings. Participants in Kentucky noted that they only received marketing newsletters from their local plant and had no way to know if the information is accurate. To address this, they stated the proposed rule should include a requirement for steam electric power plants to post information to a publicly available website in a format accessible to a general audience.
- In Texas, participants stated that they had access to general information on whether their local water had pollutants exceeding federal limits but had no information on the specific impact of their local plant on their water and soil, or of how widespread that impact is in their community. The participants recommended that EPA make this kind of data from power plants publicly available so community members can stay informed and avoid highly polluted areas.
- Community members in Florida also expressed concerns about accessibility of information on steam electric power plants and stated that a regional EPA website with information specific to steam electric power plants would be helpful. Additionally, they noted that there is an abundance of testing or monitoring data available on pollutants, but that they would like information on the compliance of the steam electric power plants to be made publicly available.

7.5.2 Environmental Concerns

In the community meetings, community members discussed environmental concerns related to their local steam electric power plants as well as other sources of pollution.

A common environmental concern from the meetings was air pollution related to steam electric power plants.

- Long-time community members in the Navajo Nation noted that, after their local plant opened, the community began to experience air pollution and visible smog. This has not abated after the installation of wet scrubber and other technologies: pollution controls are sometimes shut off at night, allowing smog to be released overnight and thus creating hazes of pollution in the morning.
- Community members in Kentucky expressed concerns about air emissions from their local plant, particularly their concerns about air pollutants eventually being deposited in soil and contaminating local aquifers and surface water.
- A community member in Texas expressed concerns about a lack of air pollution controls at their local plant.
- Concerns about air emissions from the local plant were also expressed by community members in Florida.

Concerns related to pollution in surface water and groundwater from steam electric power plants were another common environmental impact community members expressed to EPA in the meetings.

- Community participants in North Carolina expressed concerns about impacts to their local surface water from plant discharges. Several years prior, a coal ash spill at their local plant contaminated their local river with bromide and selenium. Community members have also collected surface water samples themselves that have been found to have high levels of total trihalomethanes (TTHMs). Because there are also concerns over groundwater contamination-many community members use untreated well water for drinking water-residents primarily use bottled water for drinking water and daily household activities.
- Community members in Kentucky expressed concerns related to discharges from their local plant and potential impacts on the Ohio River, which they use for swimming and fishing. While drinking water studies in Kentucky have not shown high levels of pollutants in drinking water, they were concerned about water quality.
- Community members in Texas expressed concerns about leaching of pollutants from their local plant into the groundwater. One community member reviewed groundwater monitoring well data for wells around the local power plant and found that almost every well had pollutant levels exceeding federal Maximum Contaminant Levels (MCLs). Community members also expressed concerns related to water quality impacts in downstream lakes from plant discharges, as community members fish in downstream waters of the plant and the water is used on lawns and at local parks.
- A Navajo Nation community member noted that after their local plant began operating, local surface water became murky and polluted. Community members use this water for irrigation and drinking, often boiling the water before using it for drinking and household activities. Community members also had concerns related to water quantity impacts, stating that the local plant uses significant amounts of water from local waters as cooling water.
- In Florida, a community member expressed concern over the potential for reverse tidal flow along a local surface water to lead to discharges from the local plant contaminating the waterbody. This waterbody was of particular concern because it is located in communities with minority and low-income residents and also is affected by fecal coliform contamination.

In addition to air and water impacts, communities identified impacts to land and wildlife from steam electric power plants as concerns.

- Navajo Nation community members expressed concerns about land pollution as a result of inadequate handling of coal ash waste at their local plant, with particular concern that improper land disposal will further pollute their local surface water.
- North Carolina community members expressed concerns related to coal ash contamination of soil. They also stated that impacts on wildlife have been recorded after the coal ash spill from their local plant, which killed 90 percent of fish species in their local surface water-species that had previously been a source of food for the community.
- Florida community members also expressed concern over contamination of sediment in their area from discharges of pollutants from the local plant in the local surface water. Research by the community showed materials, like mercury, had accumulated in the sediment around the surface water. The community was also concerned about impacts to fish from pollutants discharged by the local plant particularly because there are many subsistence fishers in their community (and Florida residents generally consume a higher percentage of fish and therefore require greater protections).
- In Kentucky, community members recommended that EPA consult with the U.S. Fish and Wildlife Service to determine how discharges from local plants affect local wildlife and asked that EPA consider wildlife impacts in the proposed rule.

Contributions of steam electric power plants to climate change was also mentioned as an environmental impact of concern in EPA's meeting with Navajo Nation community members. Participants noted that they are currently dealing with climate change-related issues including droughts and dust storms, which they attribute to cumulative effects of pollution including from the local plant. A community member noted that before the plant began operation, the desert had fields of flowers and reliable rain and snowfall that provided needed precipitation; the current landscape is dry and barren with ecological dead zones near the plant.

Aside from environmental impacts related to steam electric power plants, communities shared information with EPA about other sources of pollution in their community, emphasizing the importance of considering the cumulative risks that they face from multiple sources of pollution.

- Navajo Nation community members stated that they not only face pollution from steam electric power plants but also pollution from the extractives industry including uranium, oil, helium, and coal-particularly legacy pollution from waste disposal sites that have not been remediated.
- In Texas, community members stated additional impacts on air pollution, particularly ozone issues, from the urban sprawl and traffic. Their local community is also surrounded by oil wells, chemical plants, and a landfill that have had issues with leaching and polluting the land, which community members were also concerned may lead to groundwater pollution and odor problems.
- In North Carolina, community participants expressed concerns related to legacy pollution from industries no longer in the area like logging and textiles. They were also concerned about pollution from industrial agriculture including *E. coli* from poultry operations and 1,4-dioxane applied to crops. Additionally, the furniture industry in the area has caused concerns due to the lack of treatment of its waste.
- Community members in Kentucky noted a local landfill and Superfund site as major environmental concerns in the community. Community members worry about lead and per- and polyfluoroalkyl substances (PFAS) leaching from the site and polluting their water. Community participants noted orange leachate coming out of the ground and running into a nearby creek that community members use for recreation. PFAS contamination from other sources was a concern for community members in general.
- Community members in Florida also expressed interest in EPA considering cumulative effects of pollutants in its distributional analysis, particularly the cumulative effects from water and air pollution from the local power plant as well as pollution from coal ash stored at the local power plant. They also mentioned another component of cumulative risks: storm surges during extreme weather events, which they noted pose increasing challenges to their community.

7.5.3 Human Health and Safety Concerns

In each of the meetings that EPA held, communities expressed concerns to the Agency about safety and health impacts related to pollution from steam electric power plants and provided the Agency with information on general health issues in their communities.

- Navajo Nation community members expressed concerns related to health impacts from pollution from the local steam electric power plant. They stated that air pollution from the plant and extractive industries have led to chronic diseases associated with air pollution in their community noting children with respiratory and cardiac problems –in particular, observable increases in asthma-and people with cancer, emphysema, and chronic obstructive pulmonary disease (COPD). These types of diseases, as one community member noted, take years to develop.
- In North Carolina, a community member noted that for a mile stretch near a lake affected by pollution from the plant it is common for people living there to be a cancer survivor or to know someone who has died from cancer.
- In Texas, a community member noted that a study conducted by Rice University on the benefits of closing coal-fired power plants in Texas found that their local plant's particulate matter accounted for about 178 statistical deaths a year, the highest of any coal-fired power plant in Texas. I
- In Florida, community members noted that a high number of children in their community suffer from asthma.

In terms of general community health issues:

- Navajo Nation community members informed EPA that many people in their community have physical and mental disabilities; the community has high rates of cancer, cardiovascular disease, and obesity which may be exacerbated by pollution. A community member noted there are few hospitals on the reservation which makes it difficult to travel to get medical care, especially with high gas prices.
- In North Carolina, community members noted high rates of cancer, diabetes, skin disorders, and reproductive issues in the community, as well as issues with bronchitis and asthma, especially among children. Community members also experience difficulty with accessing health care as many residents are uninsured.
- In Kentucky, community members expressed concerns related to the prevalence of cancer in their community, particularly kidney and brain cancer. Participants informed EPA that a part of their community with a high proportion of low-income and Black residents has high rates of illnesses like cancer and many residents cannot afford high-quality medical care. It was found that residents in this area tend to die 10 to 12 years earlier than residents in other parts of the community. In this part of the community, participants also noted that EPA has told residents to put tarps on the ground before letting their children play outside because of potential health risks.

In EPA's meeting with Navajo Nation community members, one former employee of the local steam electric power plant expressed health and safety concerns related to working conditions at the plant. To vacuum coal ash at the plant, they were given basic personal protective equipment (disposable face mask, gloves, and safety glasses); even with this equipment, coal ash got all over them, including in their eyes and mouth. They stated they and other workers were not taught about the composition of the coal ash beforehand and were concerned about the health issues associated with it. They also described instances of contractors climbing scaffolding of smokestacks without safety harnesses and noted reports of gear and tools falling on employees.

7.5.4 Economic Impacts

Through the community meetings, particularly in North Carolina, EPA learned of widespread, long-term economic impacts resulting from environmental impacts related to steam electric power plants.

North Carolina participants informed EPA that the community has experienced widespread economic impacts due to pollution from the local plant, particularly after the coal ash spill. They noted many residents have left the community due to water and soil contamination. This had had impacts on the community, particularly through school closures due to a lack of students. The water and soil pollution has also caused a drop in home values-meaning that some residents cannot leave the community or move to other areas within it because banks have stopped providing home loans. Because of fears related to bromide and selenium in their drinking water after the coal ash spill, many residents exclusively use bottled water: a large expense, as residents noted, given that many residents are low-income. Additionally, participants informed EPA that water pollution from the coal ash spills has affected the tourism industry, the largest employer in their community and one centered around the recreational opportunities in their local waterbodies. Community members also suspected that the departure of a Miller-Coors plant-which caused the community to lose 300 jobs-was the result of the water contamination from the plant.

Navajo Nation community members also informed EPA of economic impacts in their area. A lack of dependable water has negatively affected farming, they stated. Community members rely on farming for subsistence and their livelihoods, and some people have been forced to sell their animals for income. Community members also noted the role that the local plant plays as an employer in the community. Participants noted that the plant is one of the major providers of well-paying jobs and that the majority of the people working at the plant are tribal members. Despite this, some participants remarked that the economic, environmental, and human health impacts of the pollution from the plant outweigh the employment benefits.

In Florida, participants noted that one of the foundations of their community is the fishing community and industry, particularly for blue crab and other seafood. Additionally, recreational activities, including fishing, marinas, and dining, occur close to the local plant. Within a three-mile radius of the plant, there are state and city parks where preservation and recreational activities occur, including swimming and walking trails. Community members noted that the industries, activities, and people in these areas can all be affected by pollutant discharges from the local plant.

7.5.5 Cultural and Spiritual Impacts

In the meeting with Navajo Nation community members, EPA learned how environmental degradation from the local steam electric power plant's pollution has culturally and spiritually affected the community. The San Juan River, affected by pollution, is a male river and a provider to the Diné people.

7.5.6 Communication and Public Outreach

Community members also provided EPA with recommendations to consider when communicating information about the proposed rule and conducting future meetings in their communities.

In Kentucky, community members emphasized that EPA should use communication platforms other than the rule's website. They suggested EPA consider publishing a press release, written for the general public, in their local newspaper as well as submitting an announcement to a local radio station. Additionally, because there is a substantial Spanish-speaking population in their community, EPA should offer any published materials on the proposed rule in Spanish to better inform this population. In North Carolina, community members also expressed the need for EPA to use alternative communication platforms. Because the community has no printed newspaper and limited access to internet, they said EPA should consider mail-based, radio, and door-to-door canvassing.

In Florida, community members emphasized expanding community outreach for future public meetings on the proposed rule in a targeted manner. They suggested that EPA reach out to several community groups, including the Jacksonville NAACP and Duval County Soil and Water, as well as city council members that can pass information along to their constituents. Community members also noted that EPA might increase participation if, in its outreach, it discusses the meeting and proposed rule in a simple and easy format; they also suggested focusing on discussing the rule through a local framework, *e.g.,* discussing impacts of the rule to the angling community. Additionally, more emphasis on explaining EJ would be helpful: many participants stated that EJ is not a widely understood concept in their community.

7.5.7 Concerns Relevant to Other EPA Regulatory Actions

In addition to information related to the proposed rule, community members expressed concerns about steam electric power plants that are outside the rule's scope but may be relevant for other EPA regulatory actions related to steam electric power plants.

- Navajo Nation meeting participants noted concerns that the disposal of coal combustion residuals (CCR) from their local plant had potentially contaminated their local waterways, which they use for recreation and agriculture, due to poor monitoring and handling of disposal by the owner of the plant. They stated that many of the coal ash pits are unlined; they were not aware of water quality monitoring by the plant or the regulatory community.
- In Texas, community members expressed concerns about groundwater contamination from landfills and surface impoundments. Participants did not trust that their local plant had stopped intaking coal ash in its surface impoundments and was monitoring groundwater as required by EPA's CCR rule.

8. Regulatory Options

This analysis evaluates four regulatory options and identifies one preferred option (Option 3), as shown in Table 12. All options include the same technology basis for CRL (chemical precipitation) and legacy wastewater (best professional judgment [BPJ]) while incrementally increasing controls on FGD wastewater, BA transport water, or both. Each successive option from Option 1 to 4 would achieve a greater reduction in wastewater pollutant discharges. Each subcategorization is described further in Section VII.C of the preamble.

8.1 FGD Wastewater

Option 1 would eliminate the best available technology economically achievable (BAT) and pretreatment standards for existing sources (PSES) subcategorizations for high-FGD-flow facilities and low-utilization electric generating units (LUEGUs). The effect would be establishment of the same mercury, arsenic, selenium, and nitrogen limitations applicable to the industrial category based on chemical precipitation followed by low-hydraulic-residence-time biological treatment and ultrafiltration. Options 2 and 3 would eliminate the BAT and PSES subcategorizations for high-FGD-flow facilities and LUEGUs and further would require zero discharge of FGD wastewater based on chemical precipitation followed by membrane filtration with 100 percent recycle of the permeate. These options would also create a subcategory for early adopters that have already installed compliant biological treatment systems and would retire no later than December 31, 2032. Option 4 would establish an industry-wide zero discharge requirement without establishing an early adopter subcategory. Note that all four options would retain the subcategory for electric generating units (EGUs) permanently ceasing coal combustion by 2028.

8.2 BA Transport Water

Options 1 and 2 would eliminate the BAT and PSES subcategorization for LUEGUs. The effect would be establishment of the same volumetric purge limitation applicable to the industrial category based on high-recycle-rate systems. Option 3 incorporates zero discharge based on dry handling or closed-loop systems. This option would also create a subcategory for early adopters that have already installed a compliant high-recycle-rate system and would retire no later than December 31, 2032. Option 4 would establish an industry-wide zero discharge requirement without establishing an early adopter subcategory. All four options retain the subcategory for EGUs permanently ceasing coal combustion by 2028.

8.3 CRL

All four options would establish BAT limitations and PSES for mercury and arsenic based on chemical precipitation treatment.

8.4 Legacy Wastewater

None of the four options specify a nationwide technology basis for BAT/PSES applicable to such wastewater at this time. Rather, they allow such limitations to be derived on a site-specific basis by the permitting authorities, using their BPJ.

Table 12. Regulatory Options Analyzed for the Proposed Rule

Wastestream	Subcategory	Technology Basis for BAT/PSES Regulatory Options (a)				
		2020 Rule (Baseline)	Option 1	Option 2	Option 3	Option 4
FGD Wastewater	NA (default unless in subcategory) (b)	CP + Bio	CP + Bio	CP + Membrane	CP + Membrane	CP + Membrane
	Boilers permanently ceasing the combustion of coal by 2028	SI	SI	SI	SI	SI
	Early adopters or boilers permanently ceasing the combustion of coal by 2032	NS	NS	CP + Bio	CP + Bio	NS
	High FGD Flow Facilities or Low Utilization Boilers	CP	CP + Bio	CP + Membrane	CP + Membrane	CP + Membrane
Bottom Ash Transport Water	NA (default unless in subcategory) (b)	HRR	HRR	HRR	ZLD	ZLD
	Boilers permanently ceasing the combustion of coal by 2028	SI	SI	SI	SI	SI
	Early adopters or boilers permanently ceasing the combustion of coal by 2032	NS	NS	NS	HRR	NS
	Low Utilization Boilers	BMP Plan	HRR	HRR	ZLD	ZLD
CRL	NA (default) (b)	BPJ	CP	CP	CP	CP

Abbreviations: BA = Bottom Ash; BMP = Best Management Practice; BPJ = Best Professional Judgement; 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 the Technical Development Document (TDD*)* for a description of these technologies (U.S. EPA, 2023e).

b- This table does not present existing subcategories included in the 2015 and 2020 rules as EPA did not reopen the existing subcategorization of oil-fired units or units with a nameplate capacity of 50 megawatts or less.

Source: U.S. EPA Analysis, 2023

9. Distributional Analysis of Pollutant Exposures

For the proposed 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 identified in Section 8. EPA conducted this analysis for each of the relevant pathways of exposure to pollutants from steam electric power plants: air (only analyzes Option 3), surface water, and drinking water.

The objectives of this analysis were to determine:

- Whether, through each exposure pathway, under the baseline, communities with identified PEJC experience disproportionately high and adverse pollutant exposures and/or health effects compared to communities with no identified PEJC.
- Whether disproportionately high and adverse pollutant exposures and health effects experienced by communities with PEJC were mitigated, exacerbated, or created by each of the regulatory options.

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

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

EPA analyzed air pollutant exposures[24] across all communities potentially affected by the proposed rule to evaluate whether population groups of concern experience disproportionately high and adverse exposures, compared to relevant comparison population groups, under the baseline and preferred regulatory option (Option 3). The analysis focuses on $PM_{2.5}$ and ozone exposures[25] from emissions from the steam electric power plants regulated under the proposed rule.

EPA's approach to this analysis considered the proposed regulatory provisions of Option 3, as well as the nature of known and potential exposures and impacts. As the proposed rule would regulate 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 analyzed changes in $PM_{2.5}$ and ozone concentrations resulting from the emission changes projected by the Integrated Planning Model (IPM)[26] to occur under the proposed rule as compared to the baseline, characterizing average and distributional exposures both prior to and following implementation of Option 3 in 2030. Population characteristics considered in the distributional analysis were race, ethnicity, poverty status, linguistic isolation, educational attainment, age, and sex (Table 13).[27]

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

25. 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 2023 BCA.

26. As discussed in greater detail in U.S. EPA (2018a), 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 and national electricity markets. IPM generates least-cost resource dispatch decisions based on user-specified 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 2023 Regulatory Impact Analysis (RIA) report for more details on the IPM model runs.

27. Population projections stratified by race/ethnicity, age, and sex are based on economic forecasting models developed by Woods and Poole (2015). The Woods and Poole database contains county-level projections of

Table 13. Population Characteristics Included in the Ozone and PM2.5 Distributional Analyses

Demographic Characteristics	Description
Race	Asian; American Indian; Black; White
Ethnicity	Hispanic; Non-Hispanic
Educational Attainment	Over age 24 with a high school degree or more; Over age 24 with no high school degree
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 Option 3 are relatively small in magnitude. As a result, the potential for Option 3 to mitigate or exacerbate existing PEJC is small.
- Although several future years were assessed for health benefits associated with this proposed 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 nearest future year in which all affected steam electric power plants are expected to be in compliance with Option 3.

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

As IPM predicts, Option 3 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 U.S., EPA grouped affected areas into those where air quality does not change, improves, or worsens as a result of Option 3. As air quality changes associated with Option 3 were estimated to be small, EPA used a cutoff of changes in concentrations that were at least a thousandth of each pollutant's 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 U.S.. Applying the groupings and definition of changing air quality, the results of the IPM analysis show that, under Option 3, about 40 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 Option 3, 99 percent (144.5 million) and 85 percent (155 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 Option 3, one percent (1.5 million) and 15 percent (30 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 Option 3 in areas experiencing worsening air quality are predicted to be small compared to the baseline, averaging approximately 0.01 ppb for ozone and 0.002 $\mu g/m^3$ for $PM_{2.5}$. Additionally, while increases in $PM_{2.5}$ concentrations under Option 3 are predicted for a

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).

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.

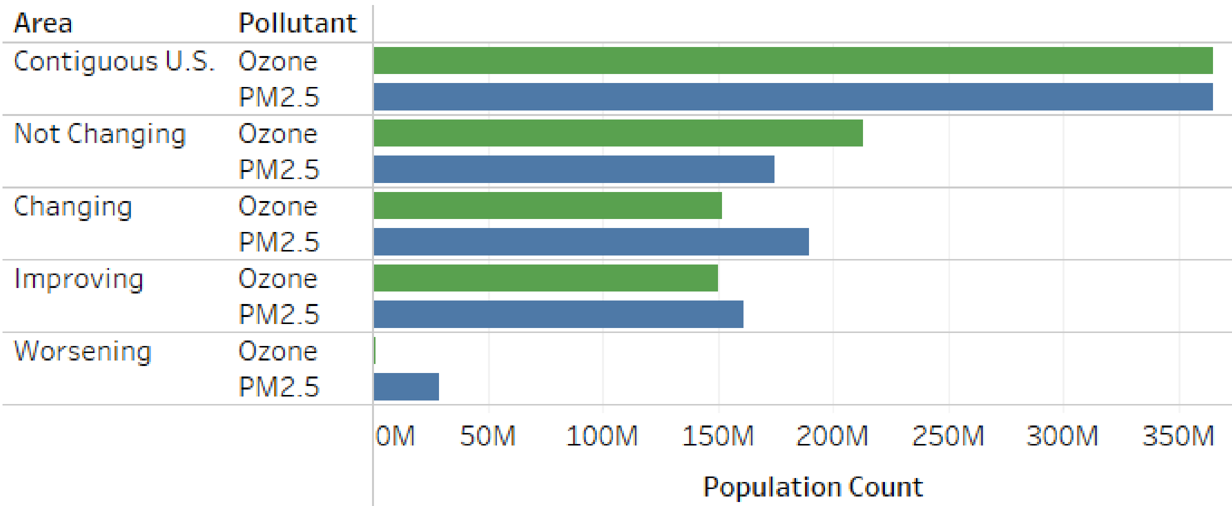

Figure 1. Number of People in the Contiguous U.S. Residing in Areas with Not Changing, Changing, Improving, and Worsening Modeled Ozone and PM2.5 Concentrations in 2030

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

For areas with predicted changes in ozone concentrations under Option 3, EPA conducted a distributional analysis to determine whether population groups of concern experience disproportionately high and adverse exposures to ozone relative to their relevant comparison population groups under the baseline and whether such PEJC are mitigated, exacerbated, or created under Option 3.

As described in Chapter 8 of the 2023 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. 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 Option 3 in 2030. The map shows areas in which the warm season (April – September) MDA8 ozone concentrations improve (shown in green) or worsen (shown in red) – by at least +/- 0.007 ppb - under Option 3.

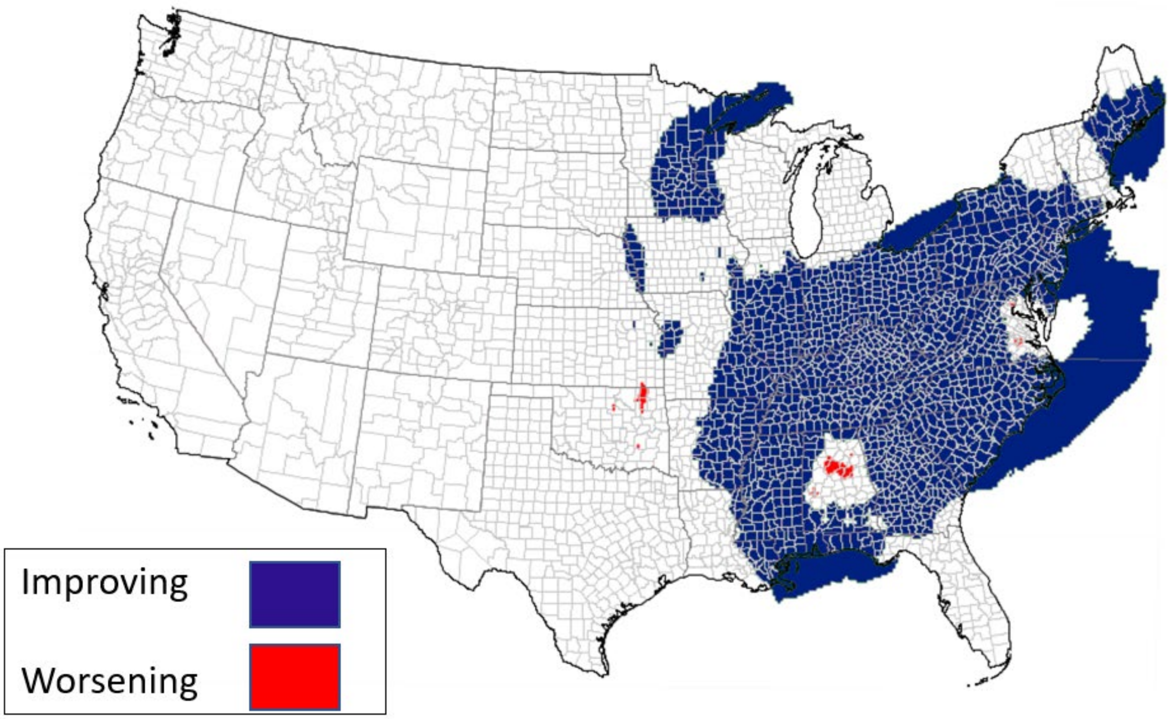

Figure 2. Map of 12-km Grid Cells with Modeled Changes in MDA8 Warm Season Ozone Concentrations Improving or Worsening by at Least +/-0.007 ppb in 2030

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 Option 3. 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 Option 3 due to IPM-projected changes in the future dispatch of certain electricity generation units after promulgation of the proposed rule.

Comparing the baseline concentrations of MDA8 ozone in areas with predicted changing ozone concentrations under Option 3 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 Option 3 have, on average, higher baseline MDA8 ozone concentrations (Figure 3). Additionally, the areas expected to experience worsening ozone concentrations under Option 3 have lower baseline average ozone concentrations than any other group (Figure 3). As the population in areas with changing ozone concentrations under Option 3 is nearly identical to the population in areas with improving ozone concentrations under Option 3, the two dots overlap in Figure 3.

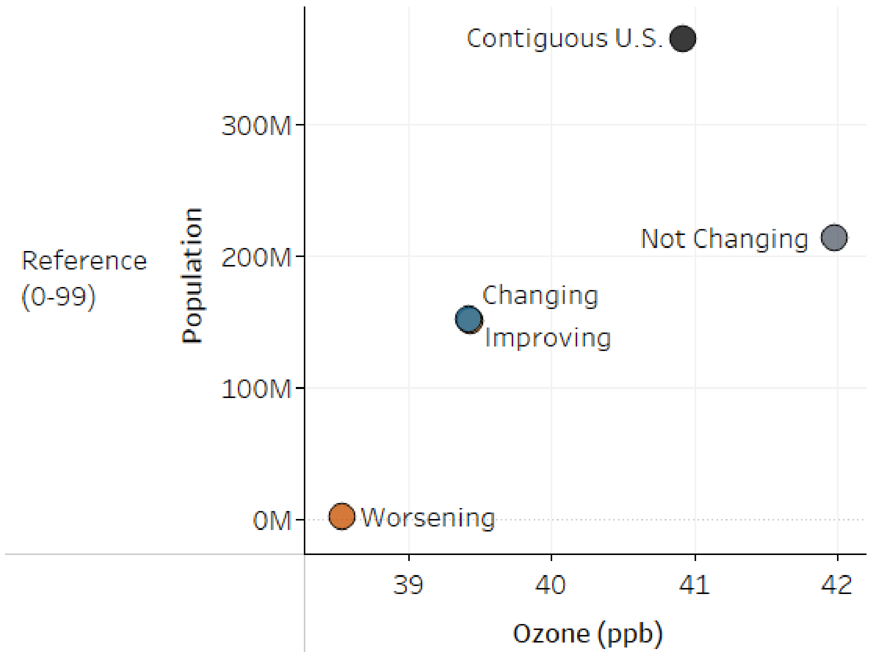

Figure 3. Baseline MDA8 Ozone Concentrations and Population Counts in Areas with Not Changing, Changing, Improving, and Worsening Modeled Ozone Concentrations in 2030

To determine whether PEJC were present under the baseline and whether they were mitigated, exacerbated, or created by Option 3, EPA modeled average baseline warm season MDA8 ozone concentrations and MDA8 ozone concentration changes under Option 3 across population groups of concern compared to the overall reference group (labelled "Reference [0-99]") and their relevant comparison groups (*e.g.,* White for racial or ethnic groups). Different areas, air quality scenarios, and methods of showing results are presented across the columns in Table 14[28], all overlaid with intensifying color gradients to support visualizing differences. The green color gradient applies to columns presenting total exposure burden and the gray gradient to columns presenting the absolute or percent change in exposure when moving from the baseline scenario to the policy scenario. More information on the columns in Table 14 can be found in Table 15.

28. 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 14. 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)	40.93	40.92	0.007	0.017	39.43	39.42	0.014	0.036	39.44	39.43	0.014	0.036	38.54	38.55	-0.011	-0.029	41.99
Race	White (0-99)	41.02	41.02	0.007	0.017	39.40	39.38	0.014	0.036	39.40	39.39	0.014	0.036	38.65	38.66	-0.011	-0.029	42.12
	American Indian (0-99)	43.02	43.02	0.004	0.008	38.87	38.86	0.013	0.033	38.81	38.80	0.014	0.035	40.88	40.89	-0.010	-0.024	44.15
	Asian (0-99)	42.00	42.00	0.005	0.012	40.45	40.44	0.012	0.030	40.46	40.45	0.013	0.031	39.73	39.74	-0.011	-0.029	42.81
	Black (0-99)	39.67	39.66	0.009	0.022	39.25	39.24	0.014	0.036	39.28	39.26	0.015	0.038	37.99	38.00	-0.011	-0.030	40.16
Ethnicity	Non-Hispanic (0-99)	40.41	40.40	0.008	0.020	39.34	39.33	0.014	0.036	39.35	39.33	0.014	0.037	38.48	38.49	-0.011	-0.029	41.35
	Hispanic (0-99)	42.77	42.77	0.004	0.009	40.10	40.09	0.013	0.031	40.11	40.10	0.013	0.032	39.08	39.09	-0.012	-0.030	43.54
Educational Attainment	More educated (>24: HS or more)	40.76	40.75	0.007	0.018	39.45	39.44	0.014	0.035	39.46	39.45	0.014	0.036	38.50	38.51	-0.011	-0.029	41.73
	Less educated (>24; no HS)	41.33	41.33	0.006	0.015	39.28	39.27	0.014	0.036	39.29	39.28	0.014	0.036	38.18	38.19	-0.011	-0.030	42.56
Poverty Status	>200% of the poverty line (0-99)	40.93	40.92	0.007	0.017	39.55	39.53	0.014	0.035	39.56	39.54	0.014	0.036	38.59	38.60	-0.011	-0.029	41.93
	<200% of the poverty line (0-99)	40.91	40.91	0.007	0.017	39.19	39.17	0.014	0.037	39.19	39.18	0.015	0.037	38.44	38.45	-0.011	-0.029	42.09
	>Poverty line (0-99)	40.93	40.92	0.007	0.017	39.47	39.46	0.014	0.035	39.48	39.47	0.014	0.036	38.53	38.55	-0.011	-0.029	41.95
	<Poverty line (0-99)	40.93	40.92	0.007	0.017	39.21	39.20	0.014	0.037	39.22	39.20	0.015	0.037	38.54	38.55	-0.011	-0.028	42.14
Linguistic Isolation	English "very well or better" (0-99)	40.81	40.80	0.007	0.018	39.38	39.37	0.014	0.036	39.39	39.37	0.014	0.037	38.50	38.51	-0.011	-0.029	41.88
	English < "very well" (0-99)	42.14	42.14	0.004	0.010	40.25	40.24	0.012	0.030	40.26	40.25	0.012	0.031	39.30	39.31	-0.012	-0.030	42.86
	English "well or better" (0-99)	40.86	40.86	0.007	0.017	39.41	39.39	0.014	0.036	39.42	39.40	0.014	0.036	38.53	38.54	-0.011	-0.029	41.93
	English < "well" (0-99)	42.19	42.18	0.004	0.010	40.24	40.22	0.012	0.030	40.24	40.23	0.012	0.031	39.10	39.11	-0.012	-0.030	42.88
Age	Children (0-17)	41.15	41.14	0.007	0.017	39.45	39.43	0.014	0.036	39.46	39.44	0.014	0.036	38.60	38.61	-0.011	-0.029	42.32
	Adults (18-64)	40.98	40.97	0.007	0.017	39.46	39.45	0.014	0.035	39.47	39.46	0.014	0.036	38.59	38.61	-0.011	-0.029	42.05
	Older Adults (65-99)	40.53	40.52	0.007	0.018	39.32	39.30	0.014	0.036	39.32	39.31	0.014	0.036	38.27	38.28	-0.011	-0.029	41.43
Sex	Females (0-99)	40.92	40.91	0.007	0.017	39.45	39.43	0.014	0.036	39.46	39.44	0.014	0.036	38.53	38.54	-0.011	-0.029	41.98
	Males (0-99)	40.94	40.93	0.007	0.017	39.41	39.40	0.014	0.036	39.42	39.41	0.014	0.036	38.55	38.56	-0.011	-0.029	42.00

Table 15. Additional Information on the Column Headers Used in Table 14

1. Contiguous U.S. Baseline	Average exposure burden under the baseline scenario averaged across the population in the entire contiguous
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 1/1000th of the NAAQS
6. Policy Areas Changing	Average exposure burden under the policy scenario averaged across the population experiencing a change of at least 1/1000th of the NAAQS
7. Changes in Policy Areas Changing	Average exposure changes when moving from the baseline to the policy scenario averaged across the population experiencing a change of at least 1/1000th of the 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 a change of at least 1/1000th of the NAAQS
9. Baseline Areas Improving	Average exposure burden under the baseline scenario averaged across the population experiencing an air quality improvement of at least 1/1000th of the NAAQS
10. Policy Areas Improving	Average exposure burden under the policy scenario averaged across the population experiencing an air quality improvement of at least 1/1000th of the 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 1/1000th of the 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 1/1000th of the
13. Baseline Areas Worsening	Average exposure burden under the baseline scenario averaged across the population experiencing an air quality worsening of at least 1/1000th of the NAAQS
14. Policy Areas Worsening	Average exposure burden under the policy scenario averaged across the population experiencing an air quality worsening of at least 1/1000th of the 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 1/1000th of the 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 1/1000th of the NAAQS
17. Areas Not Changing	Average exposure burden under the areas not changing or changing by less than 1/1000th of the NAAQS

Based on the results of the analysis, EPA determined that Option 3 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 Option 3 (shown in columns 1 and 2 in Table 14) are similar when averaged across the lower 48 states. The absolute magnitude of these changes is less than 0.01 ppb, or about a 0.01-0.02 percent change from baseline concentrations, as shown in the first and second gray-shaded columns in Table 14. 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).[29] Column 17 shows MDA8 ozone concentrations by population group in the areas that are not affected by the proposed rule.

Given that baseline MDA8 ozone concentrations for Option 3 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., 2022g) and areas changing can be more meaningfully discussed by directly addressing improving and worsening areas, columns 1-8 in Table 14 are not discussed in detail here.[30]

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 Option 3 are similar (shown in columns 11-12 and 15-16 in Table 14). This suggests that MDA8 ozone exposure disparities are not created, exacerbated, or mitigated under Option 3 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.

29. 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.

30. 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. EPA, 2022g).

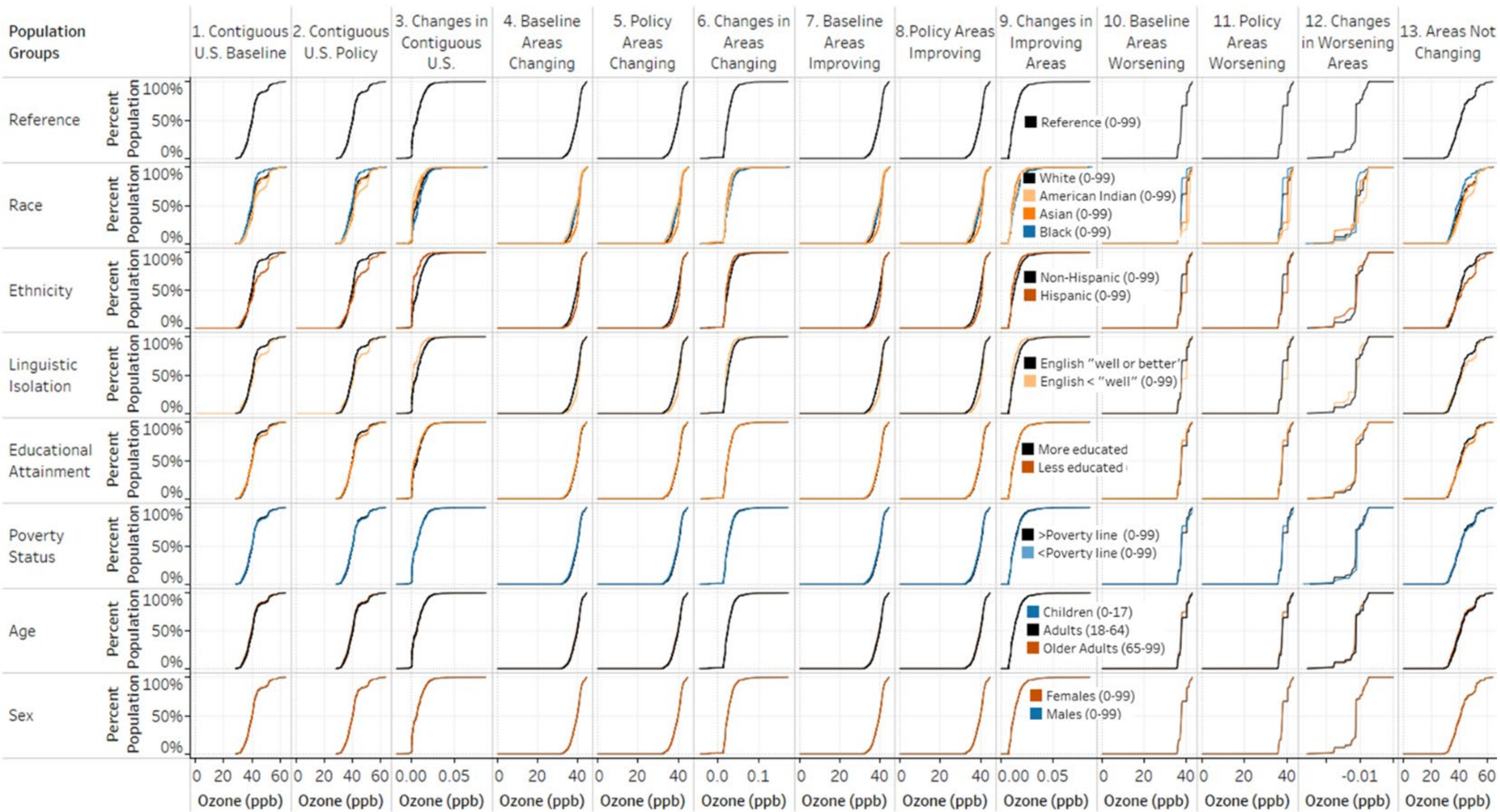

Figure 4. Distribution of Modeled MDA8 Ozone Concentrations Across Area Categories and Selected Population Groups in 2030

9.1.3 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 Option 3, EPA conducted a distributional analysis to determine whether population groups of concern experience disproportionately high and adverse exposures to annual average $PM_{2.5}$ concentrations as compared to their relevant comparison groups under the baseline and whether such PEJC are mitigated, exacerbated, or created under Option 3.

As described in Chapter 8 of the 2023 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.

Thus, reducing exposure to $PM_{2.5}$ 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 Option 3 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 Option 3.

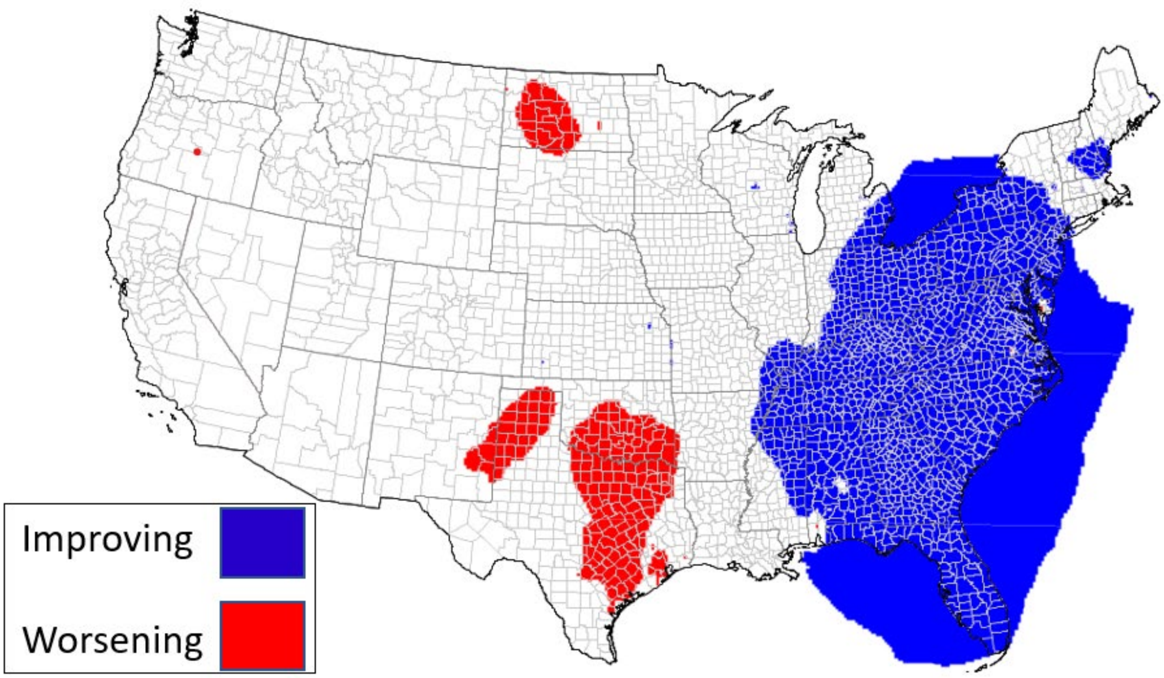

Figure 5. Map of 12-Kilometer Grid Cells with Modeled Average Annual $PM_{2.5}$ Concentrations Improving or Worsening by at Least +/-0.0012 μg/m^3 in 2030

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 Option 3.

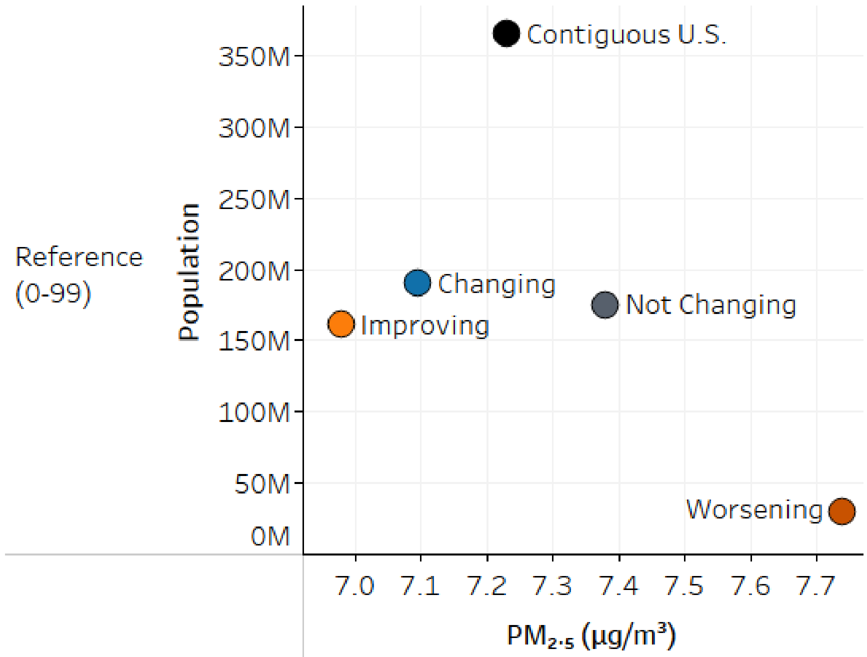

Figure 6. Baseline Average Annual $PM_{2.5}$ Concentrations and Population Counts in Areas with Not Changing, Changing, Improving, and Worsening Modeled Ozone Concentrations in 2030

Comparing baseline average annual $PM_{2.5}$ concentrations in areas with predicted change in $PM_{2.5}$ concentrations under Option 3 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 worsening $PM_{2.5}$ concentrations under Option 3 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 Option 3 in modeled future years after 2030. Additionally, average annual $PM_{2.5}$ concentration increases in these areas are on average 0.002 µg/m^3; this is considered to be a small change.

To determine whether PEJC were present under the baseline and whether they were mitigated, exacerbated, or created by Option 3, EPA modeled baseline annual average $PM_{2.5}$ concentrations and concentration changes across various population groups of concern. Table 16 presents the results. It is organized in the same way as Table 14, with rows for population groups and columns for areas, air quality scenarios, and methods.[31] A blue color gradient is applied to columns presenting total exposure burden and a gray gradient is applied to columns presenting the absolute or relative change in exposure when moving from the baseline to Option 3.

31. Numbers in Table 16 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 16. Modeled Average Annual $PM_{2.5}$ Concentrations (µg/m³) 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)	7.23	7.23	0.001	0.017	7.10	7.09	0.002	0.030	6.98	6.98	0.003	0.042	7.74	7.74	-0.002	-0.025	7.38
Race	White (0-99)	7.14	7.14	0.001	0.016	7.00	7.00	0.002	0.031	6.87	6.87	0.003	0.043	7.68	7.68	-0.002	-0.025	7.28
	American Indian (0-99)	6.75	6.75	0.000	0.005	7.01	7.01	0.001	0.017	6.94	6.93	0.003	0.039	7.15	7.15	-0.002	-0.025	6.63
	Asian (0-99)	7.80	7.80	0.001	0.011	7.42	7.42	0.002	0.024	7.27	7.27	0.003	0.036	8.16	8.16	-0.002	-0.023	8.10
	Black (0-99)	7.49	7.49	0.002	0.023	7.37	7.37	0.002	0.032	7.30	7.30	0.003	0.040	7.96	7.96	-0.002	-0.025	7.75
Ethnicity	Non-Hispanic (0-99)	7.01	7.01	0.001	0.020	7.02	7.02	0.002	0.033	6.95	6.95	0.003	0.042	7.58	7.58	-0.002	-0.026	6.99
	Hispanic (0-99)	8.02	8.02	0.001	0.007	7.42	7.41	0.001	0.018	7.15	7.15	0.003	0.039	8.02	8.02	-0.002	-0.024	8.47
Educational Attainment	More educated (>24: HS or more)	7.13	7.13	0.001	0.018	7.05	7.05	0.002	0.032	6.95	6.95	0.003	0.042	7.70	7.70	-0.002	-0.025	7.22
	Less educated (>24; no HS)	7.57	7.57	0.001	0.014	7.17	7.17	0.002	0.027	7.01	7.01	0.003	0.041	7.86	7.86	-0.002	-0.025	7.99
Poverty Status	>200% of the poverty line (0-99)	7.16	7.16	0.001	0.017	7.07	7.07	0.002	0.031	6.95	6.95	0.003	0.041	7.72	7.72	-0.002	-0.025	7.27
	<200% of the poverty line (0-99)	7.37	7.37	0.001	0.016	7.15	7.15	0.002	0.030	7.03	7.03	0.003	0.042	7.78	7.78	-0.002	-0.025	7.61
	>Poverty line (0-99)	7.20	7.20	0.001	0.017	7.08	7.08	0.002	0.030	6.96	6.96	0.003	0.042	7.73	7.73	-0.002	-0.025	7.33
	<Poverty line (0-99)	7.40	7.40	0.001	0.016	7.18	7.18	0.002	0.030	7.07	7.07	0.003	0.041	7.81	7.81	-0.002	-0.025	7.65
Linguistic Isolation	English "very well or better" (0-99)	7.15	7.15	0.001	0.018	7.06	7.06	0.002	0.031	6.96	6.95	0.003	0.042	7.68	7.69	-0.002	-0.025	7.25
	English < "very well" (0-99)	8.06	8.06	0.001	0.009	7.49	7.49	0.001	0.020	7.29	7.28	0.003	0.036	8.13	8.14	-0.002	-0.025	8.58
	English "well or better" (0-99)	7.19	7.19	0.001	0.017	7.08	7.07	0.002	0.031	6.97	6.96	0.003	0.042	7.71	7.71	-0.002	-0.025	7.31
	English < "well" (0-99)	8.18	8.18	0.001	0.009	7.54	7.54	0.001	0.019	7.33	7.33	0.003	0.035	8.17	8.17	-0.002	-0.025	8.75
Age	Children (0-17)	7.30	7.30	0.001	0.015	7.14	7.14	0.002	0.029	7.02	7.02	0.003	0.041	7.74	7.74	-0.002	-0.025	7.46
	Adults (18-64)	7.28	7.28	0.001	0.016	7.14	7.13	0.002	0.030	7.02	7.01	0.003	0.041	7.78	7.78	-0.002	-0.025	7.44
	Older Adults (65-99)	7.02	7.02	0.001	0.019	6.93	6.93	0.002	0.034	6.84	6.83	0.003	0.043	7.59	7.59	-0.002	-0.026	7.12
Sex	Females (0-99)	7.24	7.24	0.001	0.017	7.10	7.10	0.002	0.030	6.99	6.99	0.003	0.041	7.74	7.75	-0.002	-0.025	7.39
	Males (0-99)	7.22	7.22	0.001	0.017	7.09	7.08	0.002	0.030	6.97	6.96	0.003	0.042	7.74	7.74	-0.002	-0.025	7.36

Note: Additional information on the column headers can be found in Table 15.

Based on the results of the analysis, EPA determined that Option 3 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 Option 3 (columns 1 and 2 in Table 16) are similar when averaged across the lower 48 states. The absolute magnitude of these changes is about 0.001-0.002 $\mu g/m^3$, less than a 0.02 percent change from baseline concentrations, as shown in the first and second gray-shaded columns in Table 16. Columns 5-8 in the table show average annual $PM_{2.5}$ concentrations in areas with predicted changes under Option 3, which includes both areas in which average annual $PM_{2.5}$ concentrations improve (columns 9-12) or worsen (columns 13-16).[32] Column 17 shows average annual $PM_{2.5}$ concentrations by population group in areas not affected by Option 3.

Because average annual $PM_{2.5}$ concentrations in the baseline for Option 3 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 16 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 16). 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 16). This suggests that average annual $PM_{2.5}$ exposure disparities are not created, exacerbated, or mitigated under Option 3 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 disproportionately 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 disproportionately large and small exposure reductions in the population group of concerns compared to the comparison group.

32. 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.

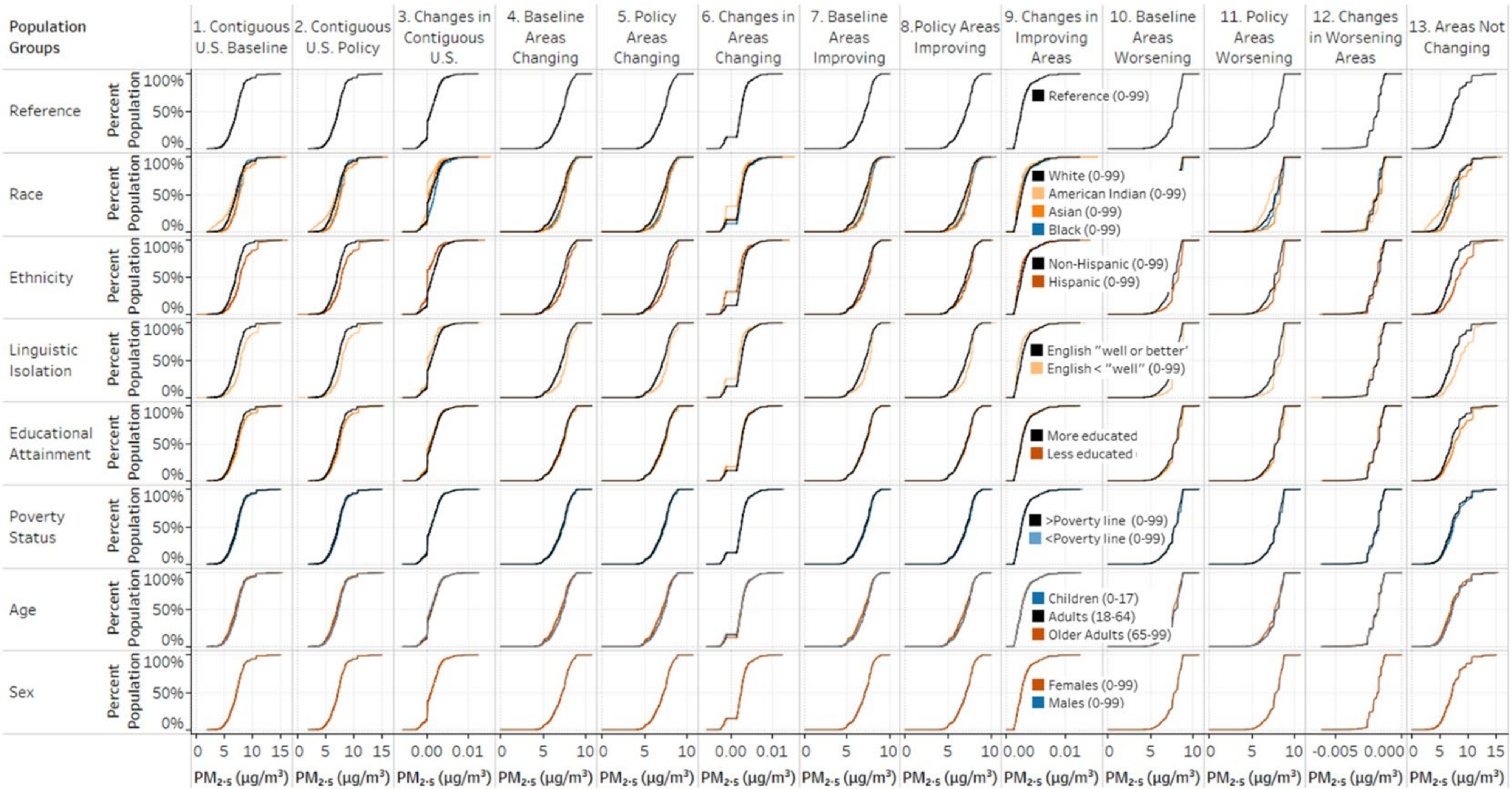

Figure 7. Distribution of Modeled Annual Average $PM_{2.5}$ Concentrations Across Area Categories and Selected Population Groups in 2030

9.1.4 Key Conclusions

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 U.S. under Option 3, 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 Option 3 are not expected to mitigate or exacerbate distributional disparities present under the baseline.

9.2 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.

9.2.1 Immediate Receiving Waters

The term "immediate receiving water" is used to describe a reach of a surface water where a discharge of wastewater occurs.[33] 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[34] 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[35] 3 (T3) and trophic level 4 (T4) fish[36]. 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[37] that consume T3 and T4 fish, respectively. Estimated fish tissue concentrations are also used to assess human health impacts–non-cancer and cancer risks[38]-to

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33. The length of the immediate receiving water, as defined in the National Hydrography Dataset Plus (NHDPlus) Version 2. See the 2023 EA for more details.

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

35. 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).

36. 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).

37. 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 a 2008 U.S. Geological Survey (USGS) study *Environmental Contaminants in Freshwater Fish and Their Risk to Piscivorous Wildlife Based on a National Monitoring Program*, 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)."

38. 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

human populations from consuming fish that are caught in contaminated receiving waters. For a more detailed discussion of the IRW Model see the 2023 EA.

EPA used the IRW Model to evaluate these impacts from steam electric power plant discharges for 98 immediate receiving waters receiving pollutant loadings from 85 plants. The results of the analyses are presented under baseline conditions and for each of the regulatory options being considered for the proposed rule. Information on the socioeconomic characteristics[39] of affected communities is included with the results from the model to evaluate the distribution of impacts (relative to the baseline) under each of the regulatory options.

9.2.1.1 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 2023 EA.

Table 17 presents the results of the IRW Model's analysis of water quality impacts for immediate receiving waters with pollutant loadings from steam electric power plants that fall under the scope of the proposed rule. 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 racial and ethnic minorities than impacted communities where immediate receiving waters do not have exceedances, and whether this distribution of impacts changes under the regulatory options.

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.

39. 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 (2015 to 2019) 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 17. Immediate Receiving Water Community Demographics by Water Quality Benchmark Exceedances[a] under the Baseline and Regulatory Options

Demographics	National Average	Baseline		Option 1		Option 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Percent Low-Income	**13.7%**	5.4%	5.9%	5.3%	5.9%	5.3%	5.9%	6.4%	5.6%
Percent African American (non-Hispanic)	**12.2%**	10.7%	6.1%	10.5%	6.7%	10.5%	6.7%	8.5%	7.5%
Percent American Indian/Alaska Native	**0.7%**	2.3%	0.8%	3.0%	0.7%	3.0%	0.7%	0.5%	1.4%
Percent Asian	**5.4%**	4.3%	0.9%	5.1%	0.9%	5.1%	0.9%	1.2%	2.2%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	**2.7%**	2.5%	2.4%	2.8%	2.3%	2.8%	2.3%	2.1%	2.5%
Percent Hispanic/Latino	**18.8%**	8.7%	4.1%	10.3%	4.0%	10.3%	4.0%	6.8%	5.4%
Total Population		89,401	178,257	69,014	198,644	69,014	198,644	41,318	226,340
Count of IRW		34	64	25	73	24	74	19	79

Source: 2023 EA.

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 2023 EA for more details on the analysis.

Under the baseline, in general, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with and without pollutant-specific benchmark exceedances (Table 17). The one exception occurs in communities with immediate receiving waters with exceedances, where the percent of the population identified as American Indian or Alaska Native (non-Hispanic) is larger than the national average (Table 17). This result is driven by baseline exceedances observed in the Unnamed tributary to the Chaco River, which is located in the Navajo Nation, an area in which about 98 percent of the population is identified as American Indian or Alaska Native (non-Hispanic). Comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the results of the baseline analysis show that communities with immediate receiving waters with exceedances have a larger proportion of the population that is African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino (Table 17). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of people in these groups is higher in communities with immediate receiving waters without exceedances, except for the American Indian or Alaska Native (non-Hispanic) Asian (non-Hispanic), and Hispanic or Latino population groups (Table 17). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 17).

The results of the analysis of regulatory options show that all options reduce the number of immediate receiving waters with pollutant-specific benchmark exceedances and the population affected by these exceedances compared to the baseline. Options 3 and 4 generate the largest reductions (Table 17).

Under Options 1 and 2, as in the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average, except for those identified as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances (Table 17). When comparing between communities with immediate receiving waters with and without exceedances, under Options 1 and 2, as in the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is larger in communities with immediate receiving waters with exceedances for African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino (Table 17). Under Options 1 and 2, increases in the precent of the population identifying as American Indian or Alaska Native (non-Hispanic), Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino were observed relative to the baseline (Table 17). While these increases were observed, it is important to note that under Options 1 and 2 the number of immediate receiving waters with exceedances and the proportion of the total affected population living in those areas decreases compared to the baseline (Table 17). Therefore, the increases in the percent of the population belonging to these groups is not due to an increase in immediate receiving water with exceedances, but rather that the remaining immediate receiving waters with exceedances under Options 1 and 2 have smaller populations with greater proportions of these racial and ethnic minority groups than the immediate receiving waters without exceedances.

Under Options 3 and 4, the percent of the population identified as low-income or a racial and ethnic minority population groups is less than the national average in communities with immediate receiving waters with and without exceedances compared to the baseline (Table 17). As opposed to Options 1 and 2, this includes the percent of the populations that identifies as American Indian and Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances, as the Unnamed tributary to the Chaco River would no longer have exceedances (Table 17). When comparing between communities with immediate receiving waters with and without exceedances, under Options 3 and 4, communities with immediate receiving waters with exceedances had a larger percent of the population identifying as low-income, African-American (non-Hispanic), and Hispanic/Latino than communities with immediate receiving waters without exceedances (Table 17). Under Options 3 and 4, in particular with the percent of the population identifying as low-income in communities with immediate receiving waters with exceedances, an increase was observed compared to the baseline (Table 17). Given that, in absolute terms, Options 3 and 4 generate the greatest reductions in the number of immediate receiving waters with exceedances and the population living in those areas compared to the baseline, this increase is likely the result of the remaining immediate receiving waters with exceedances having smaller populations with greater proportions of low-income people (Table 17). Across all racial and ethnic groups analyzed, Options 3 and 4 result in a decrease in the percent of the population in those groups compared to the baseline (Table 17).

9.2.1.1.1 Key Conclusions

Based on the results of the analysis, EPA found evidence of PEJC under the baseline among affected American Indian or Alaska Native (non-Hispanic) populations when comparing the percent of the population affected to the national average. Making an internal comparison among the affected population, EPA found PEJC among African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino populations as they comprised a larger proportion of the population in communities with immediate receiving waters with exceedances than in communities with immediate receiving waters without exceedances. Analyzing the regulatory options, EPA found that all regulatory options resulted in a reduction in the number of immediate receiving waters with exceedances and the populations affected by those exceedances compared to the baseline. EPA concluded the Options 3 and 4 generated the largest reductions in immediate receiving waters with exceedances and the population affected by the exceedances. EPA also concluded that Options 3 and 4 produced the greatest improvements in the distribution of impacts across the population groups of concern relative to the baseline.

9.2.1.1.2 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 2023 EA and Appendix D of the 2020 EA.

The following tables present the results of the analyses on impacts to sediment biota, mink, and eagles. Tables 18–20 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 and racial and ethnic minorities than impacted communities where immediate receiving waters do not have exceedances, and whether this distribution of impacts changes under the regulatory options.

Table 18. Immediate Receiving Water Community Demographics by Sediment Benchmark Exceedances[a] under Baseline and the Regulatory Options

Demographics	National Average	Baseline		Options 1 and 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Percent Low-Income	**13.7%**	7.0%	5.5%	7.0%	5.5%	6.7%	5.6%
Percent African American (non-Hispanic)	**12.2%**	8.9%	7.4%	8.9%	7.4%	9.3%	7.4%
Percent American Indian/Alaska Native	**0.7%**	4.4%	0.8%	4.4%	0.8%	0.2%	1.5%
Percent Asian	**5.4%**	1.2%	2.1%	1.2%	2.1%	1.2%	2.1%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	**2.7%**	2.2%	2.5%	2.2%	2.5%	2.3%	2.4%
Percent Hispanic/Latino	**18.8%**	5.3%	5.7%	5.3%	5.7%	5.5%	5.6%
Total Population		**38,124**	**229,534**	**38,124**	**229,534**	**36,477**	**231,181**
Count of IRW		**19**	**79**	**19**	**79**	**18**	**80**

Source: 2023 EA

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 2023 EA for more details on the analysis.

Table 19. Immediate Receiving Water Community Demographics by NEHC Exceedances[a] for Eagles (Ingesting T4 Fish) under Baseline and the Regulatory Options

Demographics	National Average	Baseline		Options 1 and 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Percent Low-Income	**13.7%**	6.9%	5.5%	6.9%	5.6%	6.5%	5.6%
Percent African American (non-Hispanic)	**12.2%**	9.9%	7.3%	10.1%	7.3%	10.6%	7.3%
Percent American Indian/Alaska Native	**0.7%**	4.9%	0.8%	5.2%	0.8%	0.2%	1.5%
Percent Asian	**5.4%**	1.3%	2.1%	1.3%	2.1%	1.3%	2.1%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	**2.7%**	2.4%	2.4%	2.5%	2.4%	2.6%	2.4%
Percent Hispanic/Latino	**18.8%**	5.9%	5.6%	6.2%	5.5%	6.4%	5.5%
Total Population		**34,461**	**233,197**	**32,392**	**235,266**	**30,745**	**236,913**
Count of IRW		**18**	**80**	**15**	**83**	**14**	**84**

Source: 2023 EA

Abbreviations: IRW (immediate receiving water); 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 2023 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 20. Immediate Receiving Water Community Demographics by NEHC Exceedances[a] for Minks (Ingesting T3 Fish) under Baseline and the Regulatory Options

	Baseline		Options 1 and 2		Options 3 and 4	
	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Percent Low-Income	6.9%	5.6%	6.9%	5.6%	6.5%	5.6%
Percent African American (non-Hispanic)	10.1%	7.3%	10.1%	7.3%	10.6%	7.3%
Percent American Indian/Alaska Native	5.2%	0.8%	5.2%	0.8%	0.2%	1.5%
Percent Asian	1.3%	2.1%	1.3%	2.1%	1.3%	2.1%
Percent Native Hawaiian/Pacific Islander	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	2.5%	2.4%	2.5%	2.4%	2.6%	2.4%
Percent Hispanic/Latino	6.2%	5.5%	6.2%	5.5%	6.4%	5.5%
Total Population	**32,392**	**235,266**	**32,392**	**235,266**	**30,745**	**236,913**
Count of IRW	**15**	**83**	**15**	**83**	**14**	**84**

Source: 2023 EA

Abbreviations: IRW (immediate receiving water); 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 2023 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 or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with and without pollutant-specific benchmark exceedances (Tables 18-20). The one exception occurs in communities with immediate receiving waters with and without exceedances, where the percent of the population identified as American Indian or Alaska Native (non-Hispanic) is larger than the national average (Tables 18-20). This result is driven by baseline exceedances observed in the Unnamed tributary to the Chaco River, which is in the Navajo Nation, an area in which about 98 percent of the population identified as American Indian or Alaska Native (non-Hispanic) (Tables 18-20). Across the three wildlife analyses, comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the results of the baseline analysis show that communities with immediate receiving waters with exceedances have a larger proportion of the population that is low-income, African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic), or Hispanic or Latino (Tables 18-20). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of people in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Tables 18-20). This is due to the fact that, across the three wildlife analyses, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Tables 18-20).

The results of the analysis of regulatory options show that none of the options increase the number of immediate receiving waters with pollutant-specific benchmark exceedances for sediment biota, eagle, and mink and the population affected by these exceedances compared to the baseline (Tables 18-20). Additionally, Options 3 and 4 generate the greatest reduction in the number of immediate receiving waters with exceedances and the population affected by these exceedances relative to the baseline (Tables 18-20).

The results of the sediment biota and mink wildlife analyses show that Options 1 and 2 do not change the number of immediate receiving waters with and without exceedances and the distribution of impacts across the population groups of concern relative to the baseline (Table 18 and Table 20).

In the eagle wildlife analysis, under Options 1 and 2, as in the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average, except for those identified as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with and without exceedances (Table 19). When comparing between communities with immediate receiving waters with and without exceedances, under Options 1 and 2, the percent of the population identified as low-income, African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic) and Hispanic or Latino is larger in communities with immediate receiving waters with exceedances (Table 19). Under Options 1 and 2, small increases in the precent of the population identifying as African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino were observed relative to the baseline (Table 19). While these increases were observed, it is important to note that under Options 1 and 2 the number of immediate receiving waters with exceedances and the proportion of the total affected population living in those areas decreases compared to the baseline (Table 19). Therefore, the increases in the percent of the population belonging to these groups is not due to an increase in immediate receiving water with exceedances, but rather that the remaining immediate receiving waters with exceedances under Options 1 and 2 have smaller populations with greater proportions of these population groups of concern than the immediate receiving waters without exceedances (Table 19).

Across the sediment biota, eagle, and mink wildlife analyses, under Options 3 and 4, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with exceedances compared to the baseline (Tables 18-20). As opposed to Options 1 and 2, this includes the percent of the population that identifies as American Indian and Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances (Tables 18-20). This is likely due to the Unnamed tributary to the Chaco River, no longer having exceedances under Options 3 and 4 compared to the baseline in all three analyses. The results of the sediment biota and mink wildlife analysis show that, when comparing between communities with immediate receiving waters with and without exceedances, under Options 3 and 4, communities with immediate receiving waters with exceedances had a larger percent of the population identifying as low-income and African-American (non-Hispanic) than communities with immediate receiving waters without exceedances (Table 18 and Table 20). In the eagle wildlife analysis, under Options 3 and 4, communities with immediate receiving waters with exceedances had a larger percent of the population identifying as low-income, African-American (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino than communities with immediate receiving waters without exceedances (Table 19). Under Options 3 and 4, in particular with the percent of the population identifying as African-American (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino in communities with immediate receiving waters with exceedances, small increases were observed compared to the baseline (Table 19). Furthermore, the results of the mink wildlife analysis show that, in communities with immediate receiving waters with exceedances, populations identified as African-American (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino had small increases in their proportion of the affected population under Options 3 and 4 compared to the baseline (Table 20). Given that across the three wildlife analyses, in absolute terms, Options 3 and 4 generate the greatest reductions in the number of immediate receiving waters with exceedances and the population living in those areas compared to the baseline, the increases observed in the eagle and mink wildlife analyses are likely the result of the remaining immediate receiving waters with exceedances having smaller populations with greater proportions of these population groups of concern (Table 19 and Table 20).

9.2.1.1.3 Key Conclusions

Based on the results of the distributional analysis of wildlife impacts, across the three analyses, EPA found that under the baseline PEJC were observed only among affected American Indian or Alaska Native (non-Hispanic) populations when comparing the percent of the population affected in communities with immediate receiving waters with pollutant-specific benchmark exceedances to the national average. Making an internal comparison between the affected population, EPA found PEJC among specific population groups of concern as they comprised a larger proportion of the population in communities with immediate receiving waters with exceedances than in communities with immediate receiving waters without exceedances. Analyzing the regulatory options across the three analyses, EPA found that Options 3 and 4 consistently generated the largest reductions in immediate receiving waters with exceedances and the population affected by the exceedances. EPA also concluded that Options 3 and 4 consistently produced the greatest improvements in the distribution of impacts across the population groups of concern relative to the baseline.

9.2.1.1.4 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 2023 EA and Appendix E of the 2020 EA.

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 x 10-6). LECRs are calculated for each immediate receiving water. If an immediate receiving water has an LECR greater than 1.00 x 10-6, EPA identified it as having an LECR exceedance.

Table 21 and Table 22 show the results from the EJ 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 21 presents the socioeconomic characteristics of communities with immediate receiving waters with and without HQs greater than one.

Table 21. Immediate Receiving Water Community Demographics by Oral RfD Exceedances[a] under Baseline and the Regulatory Options, Organized by Age and Fishing Mode Cohort

Demographics	National Average	Baseline		Option 1		Option 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Child, Recreational Fisher									
Percent Low-Income	**13.7%**	6.9%	5.4%	7.0%	5.5%	7.0%	5.5%	6.6%	5.6%
Percent African American (non-Hispanic)	**12.2%**	9.6%	7.2%	9.7%	7.3%	9.9%	7.3%	10.6%	7.3%
Percent American Indian/Alaska Native	**0.7%**	3.3%	0.8%	4.8%	0.8%	4.9%	0.8%	0.2%	1.5%
Percent Asian	**5.4%**	0.9%	2.3%	1.3%	2.1%	1.2%	2.1%	1.3%	2.1%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	**2.7%**	1.8%	2.6%	2.4%	2.4%	2.4%	2.4%	2.5%	2.4%
Percent Hispanic/Latino	**18.8%**	5.8%	5.6%	5.8%	5.6%	5.9%	5.6%	6.2%	5.5%
Total Population		56,069	211,589	35,026	232,632	34,296	233,362	32,084	235,574
Count of IRW		28	70	19	79	18	80	16	82
Adult, Recreational Fisher									
Percent Low-Income	**13.7%**	7.4%	5.4%	7.1%	5.5%	7.1%	5.5%	6.6%	5.6%
Percent African American (non-Hispanic)	**12.2%**	9.1%	7.4%	10.7%	7.3%	10.7%	7.3%	11.4%	7.2%
Percent American Indian/Alaska Native	**0.7%**	4.0%	0.8%	5.5%	0.8%	5.5%	0.8%	0.2%	1.4%
Percent Asian	**5.4%**	1.1%	2.2%	1.4%	2.1%	1.4%	2.1%	1.5%	2.1%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	**2.7%**	2.1%	2.5%	2.6%	2.4%	2.6%	2.4%	2.8%	2.4%
Percent Hispanic/Latino	**18.8%**	4.9%	5.8%	5.9%	5.6%	5.9%	5.6%	6.2%	5.6%
Total Population		42,822	224,836	30,722	236,936	30,722	236,936	28,510	239,148
Count of IRW		23	75	15	83	15	83	13	85
Child, Subsistence Fisher									
Percent Low-Income	**13.7%**	5.2%	6.0%	5.6%	5.8%	5.6%	5.8%	7.1%	5.5%
Percent African American (non-Hispanic)	**12.2%**	11.0%	5.9%	12.2%	6.4%	12.2%	6.4%	9.6%	7.3%

Table 21. Immediate Receiving Water Community Demographics by Oral RfD Exceedances[a] under Baseline and the Regulatory Options, Organized by Age and Fishing Mode Cohort

Demographics	National Average	Baseline		Option 1		Option 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Percent American Indian/Alaska Native	**0.7%**	2.1%	0.9%	2.9%	0.9%	2.9%	0.9%	0.3%	1.5%
Percent Asian	**5.4%**	4.1%	0.9%	5.6%	1.0%	5.6%	1.0%	1.2%	2.2%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%
Percent Other (non-Hispanic)	**2.7%**	2.5%	2.4%	2.9%	2.3%	2.9%	2.3%	2.1%	2.5%
Percent Hispanic/Latino	**18.8%**	8.4%	4.2%	9.6%	4.5%	9.6%	4.5%	5.1%	5.7%
Total Population		90,571	177,087	58,580	209,078	58,580	209,078	40,610	227,048
Count of IRW		35	63	25	73	24	74	21	77
Adult, Subsistence Fisher									
Percent Low-Income	**13.7%**	6.9%	5.4%	7.0%	5.5%	7.0%	5.5%	6.5%	5.6%
Percent African American (non-Hispanic)	**12.2%**	9.6%	7.2%	9.7%	7.3%	9.7%	7.3%	10.3%	7.3%
Percent American Indian/Alaska Native	**0.7%**	3.3%	0.8%	4.8%	0.8%	4.8%	0.8%	0.2%	1.5%
Percent Asian	**5.4%**	0.9%	2.3%	1.3%	2.1%	1.3%	2.1%	1.4%	2.1%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	**2.7%**	1.8%	2.6%	2.4%	2.4%	2.4%	2.4%	2.5%	2.4%
Percent Hispanic/Latino	**18.8%**	5.8%	5.6%	5.8%	5.6%	5.8%	5.6%	6.1%	5.6%
Total Population		56,069	211,589	35,026	232,632	35,026	232,632	32,814	234,844
Count of IRW		28	70	19	79	19	79	17	81

Source: 2023 EA

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 2023 EA for more details on the analysis.

Child Recreational Consumption

Under the baseline, in general, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with and without non-cancer HQs greater than one (Table 21). The one exception occurs in communities with immediate receiving waters with and without exceedances, where the percent of the population identified as American Indian or Alaska Native (non-Hispanic) is larger than the national average (Table 21). Comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the results of the baseline analysis show that communities with immediate receiving waters with exceedances have a larger proportion of the population that is low-income, African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), and Hispanic or Latino (Table 21). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of people in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 21). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 21).

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 affected by these HQ exceedances compared to the baseline (Table 21). Options 3 and 4 generate the largest reductions (Table 21).

Under Options 1 and 2, as in the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average, except for those identified as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with and without exceedances (Table 21). When comparing between communities with immediate receiving waters with and without exceedances, under Options 1 and 2, the percent of the population identified as low-income, African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), and Hispanic or Latino is larger in communities with immediate receiving waters with exceedances (Table 21). Under Options 1 and 2, small increases in the proportion of the population identifying as these population groups of concern and Asian (non-Hispanic) and Other (non-Hispanic) populations were observed relative to the baseline (Table 21). It is important to note that under Options 1 and 2 the number of immediate receiving waters with exceedances and the proportion of the total affected population living in those areas decreases compared to the baseline (Table 21). Therefore, the increases in the percent of the population belonging to these groups is not due to an increase in immediate receiving water with exceedances, but rather that the remaining immediate receiving waters with exceedances under Options 1 and 2 have smaller populations with greater proportions of these population groups of concern than the immediate receiving waters without exceedances (Table 21).

Under Options 3 and 4, in general, the percent of the population identified as low-income or a racial and ethnic minority population groups is less than the national average in communities with immediate receiving waters with and without exceedances compared to the baseline (Table 21). As opposed to Options 1 and 2, this includes the percent of the population that identifies as American Indian and Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances (Table 21). This change is likely due to Options 3 and 4 removing exceedances for the Unnamed tributary to the Chaco River which is in a tribal area. When comparing between communities with immediate receiving waters with and without exceedances, under Options 3 and 4, communities with immediate receiving waters with exceedances had a larger percent of the population identifying as low-income, African-American (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino than communities with immediate receiving waters without exceedances (Table 21). Under Options 3 and 4, for these population groups of concern and Asian (non-Hispanic) populations, small increases were observed compared to the baseline (Table 21). Given that, in absolute terms, Options 3 and 4 generate the greatest reductions in the number of immediate receiving waters with exceedances and the population living in those areas compared to the baseline, this increase is likely the result of the remaining immediate receiving waters with exceedances having smaller populations with greater proportions of low-income, African-American (non-Hispanic), Asian (non-Hispanic) Other (non-Hispanic) and Hispanic or Latino individuals (Table 21).

Adult Recreational Consumption

Under the baseline, in general, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with and without non-cancer HQs greater than one (Table 21). The one exception occurs in communities with immediate receiving waters with and without exceedances, where the percent of the population identified as American Indian or Alaska Native (non-Hispanic) is larger than the national average (Table 21). Comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the results of the baseline analysis show that communities with immediate receiving waters with exceedances have a larger proportion of the population that is low-income, African-American (non-Hispanic), and American Indian or Alaska Native (non-Hispanic) (Table 21). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of people in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 21). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 21).

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 affected by these HQ exceedances compared to the baseline (Table 21). Options 3 and 4 generate the largest reductions (Table 21).

Under Options 1 and 2, as in the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average, except for those identified as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with and without exceedances (Table 21). When comparing between communities with immediate receiving waters with and without exceedances, under Options 1 and 2, the percent of the population identified as low-income, African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Asian (non-Hispanic), and Hispanic or Latino is larger in communities with immediate receiving waters with exceedances (Table 21). Under Options 1 and 2, for these population groups of concern, except low-income populations, small increases in their proportion of the affected population were observed relative to the baseline (Table 21). It is important to note that, again, the increases in the percent of the population belonging to these groups is due to the remaining immediate receiving waters with exceedances under Options 1 and 2 have smaller populations with greater proportions of these population groups of concern (Table 21).

Under Options 3 and 4, in general, the percent of the population identified as low-income or a racial and ethnic minority population groups is less than the national average in communities with immediate receiving waters with and without exceedances compared to the baseline (Table 21). As opposed to Options 1 and 2, this includes the percent of the population that identifies as American Indian and Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances (Table 21). This change is likely due to Options 3 and 4 removing exceedances for the Unnamed tributary to the Chaco River which is in a tribal area (Table 21). When comparing between communities with immediate receiving waters with and without exceedances, under Options 3 and 4, communities with immediate receiving waters with exceedances had a larger percent of the population identifying as low-income, African-American (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino than communities with immediate receiving waters without exceedances (Table 21). Under Options 3 and 4, for these population groups of concern (except for low-income populations) and Asian (non-Hispanic) populations, small increases in their proportion of the affected population were observed compared to the baseline

(Table 21). This increase is likely the result of the remaining immediate receiving waters with exceedances having smaller populations with greater proportions of these population groups of concern (Table 21).

Child Subsistence Consumption

Under the baseline, in general, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with and without non-cancer HQs greater than one (Table 21). The one exception occurs in communities with immediate receiving waters with and without exceedances, where the percent of the population identified as American Indian or Alaska Native (non-Hispanic) is larger than the national average (Table 21). Comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the results of the baseline analysis show that communities with immediate receiving waters with exceedances have a larger proportion of the population that is African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Asian (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino. (Table 21). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of people in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 21). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 21).

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 affected by these HQ exceedances compared to the baseline (Table 21). Options 3 and 4 generate the largest reductions (Table 21).

Under Options 1 and 2, as in the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average, except for those identified as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with and without exceedances (Table 21). When comparing between communities with immediate receiving waters with and without exceedances, the percent of the population is larger in communities with immediate receiving waters with exceedances for the same population groups of concern as in the baseline (Table 21). Under Options 1 and 2, for these population groups of concern and low-income populations small increases in their proportion of the affected population were observed relative to the baseline (Table 21). This is due to the remaining immediate receiving waters with exceedances under Options 1 and 2 having smaller populations with greater proportions of these population groups of concern (Table 21).

Under Options 3 and 4, in general, the percent of the population identified as low-income or a racial and ethnic minority population groups is less than the national average in communities with immediate receiving waters with and without exceedances compared to the baseline (Table 21). As opposed to Options 1 and 2, this includes the percent of the population that identifies as American Indian and Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances (Table 21). This change is likely due to Options 3 and 4 removing exceedances for the Unnamed tributary to the Chaco River which is in a tribal area. When comparing between communities with immediate receiving waters with and without exceedances, under Options 3 and 4, communities with immediate receiving waters with exceedances had a larger percent of the population identifying as low-income, African-American (non-Hispanic), and Native Hawaiian or Pacific Islander (non-Hispanic) than communities with immediate receiving waters without exceedances (Table 21). Under Options 3 and 4, for these population groups of concern, small increases in their proportion of the affected population were observed compared to the baseline (Table 21). This increase is likely the result of the remaining immediate receiving waters with exceedances having smaller populations with greater proportions of these population groups of concern.

Adult Subsistence Consumption

Under the baseline, in general, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with and without non-cancer HQs greater than one (Table 21). The one exception occurs in communities with immediate receiving waters with and without exceedances, where the percent of the population identified as American Indian or Alaska Native (non-Hispanic) is larger than the national average (Table 21). Comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the results of the baseline analysis show that communities with immediate receiving waters with exceedances have a larger proportion of the population that is low-income, African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), and Hispanic or Latino (Table 21). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of people in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 21). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 21).

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 affected by these HQ exceedances compared to the baseline (Table 21). Options 3 and 4 generate the largest reductions (Table 21).

Under Options 1 and 2, as in the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average, except for those identified as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with and without exceedances (Table 21). When comparing between communities with immediate receiving waters with and without exceedances, the percent of the population is larger in communities with immediate receiving waters with exceedances for the same population groups of concern as in the baseline (Table 21). Under Options 1 and 2, for these population groups of concern, small increases in their proportion of the affected population were observed relative to the baseline (Table 21). This is due to the remaining immediate receiving waters with exceedances under Options 1 and 2 having smaller populations with greater proportions of these population groups of concern (Table 21).

Under Options 3 and 4, in general, the percent of the population identified as low-income or a racial and ethnic minority population groups is less than the national average in communities with immediate receiving waters with and without exceedances compared to the baseline (Table 21). As opposed to Options 1 and 2, this includes the percent of the population that identifies as American Indian and Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances (Table 21). This change is likely due to Options 3 and 4 removing exceedances for the Unnamed tributary to the Chaco River which is in a tribal area. When comparing between communities with immediate receiving waters with and without exceedances, under Options 3 and 4, communities with immediate receiving waters with exceedances had a larger percent of the population identifying as low-income, African-American (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino than communities with immediate receiving waters without exceedances (Table 21). Under Options 3 and 4, for these population groups of concern and Asian (non-Hispanic) populations, small increases in their proportion of the affected population were observed compared to the baseline (Table 21). This increase is likely the result of the remaining immediate receiving waters with exceedances having smaller populations with greater proportions of these population groups of concern.

Table 22. Immediate Receiving Water Community Demographics by Lifetime Excess Cancer Risk (LECR) Exceedances[a] above 1.00 x 10-6 for Arsenic under Baseline and the Regulatory Options, Organized by Age and Fishing Mode Cohort

Demographics	National Average	Baseline		Options 1 and 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Child, Subsistence Fisher; Adult, Recreational Fisher [b]							
Percent Low-Income	**13.7%**	1.1%	5.7%	Not applicable (NA)	5.7%	NA	5.7%
Percent African American (non-Hispanic)	**12.2%**	0%	7.7%	NA	7.7%	NA	7.7%
Percent American Indian/Alaska Native	**0.7%**	0%	1.3%	NA	1.3%	NA	1.3%
Percent Asian	**5.4%**	1.8%	2.0%	NA	2.0%	NA	2.0%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0%	0.1%	NA	0.1%	NA	0.1%
Percent Other (non-Hispanic)	**2.7%**	0.4%	2.4%	NA	2.4%	NA	2.4%
Percent Hispanic/Latino	**18.8%**	0%	5.7%	NA	5.6%	NA	5.6%
Total Population		1,687	265,971	0	267,658	0	267,658
Count of IRW		1	97	0	98	0	98
Adult, Subsistence Fisher							
Percent Low-Income	**13.7%**	8.2%	5.5%	7.5%	5.7%	1.1%	5.7%
Percent African American (non-Hispanic)	**12.2%**	12.4%	7.3%	0.2%	7.7%	0%	7.7%
Percent American Indian/Alaska Native	**0.7%**	9.3%	0.7%	48.4%	0.7%	0%	1.3%
Percent Asian	**5.4%**	1.7%	2.0%	0.9%	2.0%	1.8%	2.0%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.2%	0.1%	0%	0.1%	0%	0.1%
Percent Other (non-Hispanic)	**2.7%**	3.1%	2.4%	0.4%	2.4%	0.4%	2.4%
Percent Hispanic/Latino	**18.8%**	4.2%	5.7%	1.3%	5.7%	0%	5.7%

Table 22. Immediate Receiving Water Community Demographics by Lifetime Excess Cancer Risk (LECR) Exceedances[a] above 1.00 x 10-6 for Arsenic under Baseline and the Regulatory Options, Organized by Age and Fishing Mode Cohort

Demographics	National Average	Baseline		Options 1 and 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Total Population		17,707	249,951	3,334	264,324	1,687	265,971
Count of IRW		9	89	2	96	1	97

Source: 2023 EA

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 2023 EA for more details on the analysis.

b – The same IRW exceeds the LECR of one-in-a-million for the two cohorts listed [i.e., child (subsistence) and adult (recreational) fishers].

Child Subsistence and Adult Recreational Consumption

Under the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with and without non-cancer HQs greater than one (Table 22). The one exception occurs in communities with immediate receiving waters without exceedances, where the percent of the population identified as American Indian or Alaska Native (non-Hispanic) is larger than the national average (Table 22). Comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the results of the baseline analysis show that communities with immediate receiving waters with exceedances have a smaller proportions of the population identified as a population groups of concern (Table 22).

The results of the analysis show no arsenic LECR exceedances in any of the affected immediate receiving waters under each of the four regulatory options (Table 22).

Adult Subsistence Consumption

Under the baseline, in general, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with and without arsenic LECR exceedances (Table 22). The one exception occurs in communities with immediate receiving waters with exceedances, where the percent of the population identified as African-American (non-Hispanic) and American Indian or Alaska Native (non-Hispanic) are larger than the national average (Table 22). Comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the results of the baseline analysis show that communities with immediate receiving waters with exceedances have a larger proportion of the population that is low-income, African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), and Other (non-Hispanic) (Table 22). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of people in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 22). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 22).

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 population affected by these exceedances compared to the baseline (Table 22). Options 3 and 4 generate the largest reductions (Table 22).

Under Options 1 and 2, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average, except for those identified as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances (Table 22). When comparing between communities with immediate receiving waters with and without exceedances, the percent of the population is larger in communities with immediate receiving waters with exceedances for the same population group of concern (Table 22). Under Options 1 and 2, for the proportion of the population identified as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances, a large increase in their proportion of the affected population was observed relative to the baseline (Table 22). This is likely due to one of the remaining immediate receiving waters with exceedances under Options 1 and 2 being the Unnamed tributary to the Chaco River which is located in a tribal area.

Under Options 3 and 4, the percent of the population identified as low-income or a racial and ethnic minority population groups is less than the national average in communities with immediate receiving waters with and without exceedances compared to the baseline, except for American Indian and Alaska Native (non-Hispanic) populations in communities with immediate receiving waters without exceedances (Table 22). As opposed to Options 1 and 2, this includes the percent of the population that identifies as

American Indian and Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances (Table 22). This change is likely due to Options 3 and 4 removing exceedances for the Unnamed tributary to the Chaco River. When comparing between communities with immediate receiving waters with and without exceedances, under Options 3 and 4, communities with immediate receiving waters with exceedances had a smaller percent of the population identifying as a population groups of concerns across all population groups (Table 22).

9.2.1.1.5 Key Conclusions

Based on the results of the distributional analysis of non-cancer and cancer human health impacts, across the three analyses, EPA found that under the baseline PEJC were observed largely among affected American Indian or Alaska Native (non-Hispanic) populations when comparing the percent of the population affected in communities with immediate receiving waters with non-cancer and cancer benchmark exceedances to the national average. Making an internal comparison between the affected population, EPA found PEJC among specific population groups of concern as they comprised a larger proportion of the population in communities with immediate receiving waters with exceedances than in communities with immediate receiving waters without non-cancer and cancer exceedances. Analyzing the regulatory options across the analyses, EPA found that Options 3 and 4 consistently generated the largest reductions in immediate receiving waters with non-cancer and cancer exceedances and the population affected by these exceedances. EPA also concluded that Options 3 and 4 consistently produced the greatest improvements in the distribution of impacts across the population groups of concern relative to the baseline.

9.2.1.2 Distribution of Health Effects among Subsistence Populations

As the results in Tables 21 and 22 show, under the baseline and regulatory options, the total number of immediate receiving waters with non-cancer or cancer benchmark exceedances is greater among adult and child subsistence fish consumers than adult and child recreational fish consumers. Minority populations, low-income populations, and indigenous people are more likely to consume fish for subsistence than the general population (2020 EA, Appendix E). Subsistence fish consumers' higher consumption rates compared to recreational consumers increases their exposure to pollutants and their risks of adverse health impacts (2020 EA, Appendix E). Therefore, these results indicate the potential for disproportionately high and adverse health effects under the baseline and regulatory options to population groups of concern.

9.2.2 Downstream Surface Waters

As part of the economic analysis for the proposed rule, EPA used the D-FATE model to calculate concentrations of pollutants in downstream reaches of surface waters that receive discharges from steam electric power plants. EPA used these concentrations to estimate fish tissue concentrations in downstream reaches of receiving waters 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 2023 BCA.

EPA then 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 are likely to be affected by changes in pollutant concentrations in fish tissues. EPA conducted three analyses to evaluate human health effects among relevant cohorts from various pollutant exposures under the baseline and regulatory options:

- Lead exposure from fish consumption: This analysis evaluated 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.

- **Mercury exposure from fish consumption:** This analysis also evaluated potential neurological and cognitive impacts to children (ages 0-7) in terms of avoided IQ point losses from exposure to mercury through recreational and subsistence fish consumption.
- **Arsenic exposure from fish consumption:** This analysis evaluated potential cancer risk impacts to adults, expressed as avoided cancer cases, from exposure to arsenic through recreational and subsistence fish consumption.

After completing 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 disproportionately high and adverse health impacts to population groups of concern under the baseline and regulatory options. The results of the analysis are presented and discussed below.[41]

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

Table 23 presents the total IQ points under the baseline and the change in avoided IQ point losses under each regulatory option, for child subsistence and recreational fish consumers, by race and ethnic population group.

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 2019 American Community Survey data (U.S. Census Bureau, 2022a).

41. The results of the downstream analysis are presented as aggregate changes in avoided IQ points losses and avoided cancer cases for the various racial and ethnic population groups and income groups as a whole, rather than as changes in avoided IQ point losses and avoided cancer cases for an average individual in a group. EPA chose to do this because the changes in avoided IQ point losses and avoided cancer cases were small. Presenting them for an average individual in a group would therefore have resulted in EPA reporting small fractions of an IQ point or cancer case, which EPA concluded would not be informative. For example, the largest change under the regulatory options across analyses was 2,480 avoided IQ point losses for children not below the poverty level exposed to mercury through fish consumption at recreational rates. The change in avoided IQ point losses, if presented for an average individual in the group, would have been 0.18 avoided IQ point losses (Table 26). All other results from the downstream analysis with smaller changes would have resulted in even smaller fractions of an IQ point or cancer case being reported for an average individual.

Table 23. Modeled Total IQ Points Under the Baseline and Change in Avoided IQ Point Losses under the Regulatory Options Among Child Subsistence and Recreational Fish Consumers Exposed to Lead through Fish Consumption, by Racial or Ethnic Population Group

Cohort Group	Race/Ethnic Group	Exposed Population[a]	Baseline Total IQ Points[b]	Option 1	Option 2	Option 3	Option 4
Child Subsistence	White	57,963 (68.2%)	897,684 (68.0%)	0	<1.0	<1.0	<1.0
	Black	16,124 (19.0%)	251,240 (19.0%)	<1.0	<1.0	<1.0	<1.0
	Hispanic	4,652 (5.48%)	73,483.1 (5.56%)	0	<1.0	<1.0	<1.0
	Asian	3,282 (3.86%)	52,789.5 (4.00%)	0	<1.0	<1.0	<1.0
	American Indian and Alaska Native	484 (0.571%)	7,795.60 (0.590%)	0	<1.0	<1.0	<1.0
	Other	2,447 (2.88%)	39,390.7 (2.98%)	0	<1.0	<1.0	<1.0
Child Recreation	White	844,695 (68.2%)	12,695,700 (68.1%)	0	<1.0	<1.0	<1.0
	Black	234,981 (19.0%)	3,546,460 (19.0 %)	0	0	<1.0	<1.0
	Hispanic	67,806 (5.48%)	1,025,240 (5.50%)	0	<1.0	<1.0	<1.0
	Asian	47,843 (3.86%)	724,459 (3.89%)	0	<1.0	<1.0	<1.0
	American Indian and Alaska Native	7,066 (0.571%)	106,996 (0.574%)	0	<1.0	<1.0	<1.0
	Other	35,670 (2.88%)	540,744 (2.90%)	0	<1.0	<1.0	<1.0

Notes:

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

b- The baseline total IQ points for each racial and ethnic population 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 child subsistence and recreational fish consumers indicates that under the baseline and regulatory options, population groups of concern do not experience disproportionately high and adverse impacts compared to the White population group (Table 23).

For the baseline, a comparison of each racial and ethnic population group's share of the cohort's total IQ points compared to its share of the cohort's total exposed population showed that Black, Hispanic, Asian, American Indian and Alaska Native, and other population groups had either the same or a larger share of IQ points compared to their share of the exposed population (Table 23). In comparison, the White population group had a smaller share of IQ points compared to its share of the exposed population (Table 23).

Examining the impact of the regulatory options on avoided IQ point losses in the various racial and ethnic population groups showed that for both child subsistence and recreational fish consumer cohorts, all of the regulatory options resulted in avoided IQ point losses, compared to the baseline, across all of the population groups (Table 23). Additionally, the regulatory options resulted in no change in the share of IQ points for each population group relative to their share of the exposed population, compared to the baseline, as the changes in avoided IQ point losses were small (Table 23). For the child subsistence consumer cohort, Option 1 resulted in avoided IQ points losses for the Black population group, and no changes in avoided IQ point losses for the other population groups (Table 23). Options 2, 3, and 4 resulted in avoided IQ point losses across all population groups, with Option 4 generating the greatest combined avoided IQ point losses (Table 23). For the child recreational consumer cohort, Option 1 did not result in a change in avoided IQ point losses for any of the population groups (Table 23). Option 2 generated avoided IQ point losses across all population groups, except for the Black population group, which experienced no change in avoided IQ point losses (Table 23). Options 3 and 4 resulted in avoided IQ point losses across all population groups, with both options resulting in the largest combined avoided IQ point losses (Table 23).

Table 24 presents the total IQ points under the baseline and change in avoided IQ point losses under each of the regulatory options for child subsistence and recreational fish consumers, by income group (below the poverty line or not below the poverty line).

Table 24. Modeled Total IQ Points under the Baseline and Change in Avoided IQ Point Losses Under the Regulatory Options Among Child Subsistence and Recreational Fish Consumers Exposed to Lead through Fish Consumption, by Income Group

Cohort Group	Income Group	Exposed Population[a]	Baseline Total IQ Points[b]	Option 1	Option 2	Option 3	Option 4
Child Subsistence	Below the Poverty Line	12,324 (14.5%)	192,191 (14.5%)	<1.0	<1.0	<1.0	<1.0
	Not Below the Poverty Line	72,361 (85.5%)	1,130,190 (85.5%)	<1.0	<1.0	<1.0	<1.0
Child Recreation	Below the Poverty Line	179,607 (14.5%)	2,708,790 (14.5%)	0	<1.0	<1.0	<1.0
	Not Below the Poverty Line	1,058,460 (85.5%)	15,930,800 (85.5%)	0	<1.0	2.27	2.27

Notes:

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

b- 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 child subsistence and recreational fish consumers indicate that under the baseline and regulatory options there are not disproportionately high and adverse impacts to those below the poverty line compared to those not below the poverty line (Table 24). An additional analysis of IQ points under the baseline and the change in avoided IQ point losses under each regulatory option for child subsistence and recreational consumer cohorts by income group, controlling for race and ethnicity, confirmed these conclusions (Appendix E, Table E-1).

When evaluating results for child subsistence and recreational fish consumer cohorts under the baseline, a comparison of each income group's share of each cohort's total IQ points compared to its share of each cohort's total exposed population showed that each income group's share of the total IQ points is proportionally equivalent to its share of the exposed population (Table 24).

Examining the impact of the regulatory options on avoided IQ point losses in both income groups showed that for both child subsistence and recreational fish consumers cohorts, all of the regulatory options resulted in avoided IQ point losses (Table 24). Additionally, while the regulatory options generally resulted in greater avoided IQ point losses for those not below the poverty line in absolute terms, this did not change the share of IQ points for each population group relative to their share of the exposed population, compared to the baseline, as the changes in avoided IQ point losses were small (Table 24). For the child subsistence consumer cohort, all of the regulatory options resulted in avoided IQ point losses for both income groups, with Option 4 generating the largest combined avoided IQ point losses (Table 24). For the child recreational consumer cohort, Option 1 resulted in no change in avoided IQ point losses for both income groups (Table 24). Options 2, 3, and 4 resulted in avoided IQ point losses for both income groups, with Options 3 and 4 generating the largest combined avoided IQ point losses (Table 24).

9.2.2.2 Distribution of Health Impacts Among Children Exposed to Mercury Through Fish Consumption

Table 25 presents the total IQ points under the baseline and the change in avoided IQ point losses under each regulatory option, for child subsistence and recreational fish consumers, by race and ethnic population group.

Table 25. Modeled Total IQ Points Under the Baseline and Change in Avoided IQ Point Losses under the Regulatory Options Among Child Subsistence and Recreational Fish Consumers Exposed to Mercury through Fish Consumption, by Racial or Ethnic Population Group

Cohort Group	Race/Ethnic Group	Exposed Populationa	Baseline Total IQ Pointsb	Option 1	Option 2	Option 3	Option 4
Child Subsistence	White	7,394 (66.3%)	46,185.9 (59.6%)	364	369	376	376
	Black	2,248 (20.2%)	15,496.9 (20.0%)	109	111	114	115
	Hispanic	666 (5.97%)	5,907.58 (7.62%)	37.0	37.9	40.4	40.4
	Asian	457 (4.11%)	5,407.87 (6.98%)	28.5	29.3	31.5	31.6
	American Indian and Alaska Native	58 (0.525%)	685.780 (0.885%)	2.93	2.99	3.65	3.65
	Other	322 (2.90%)	3,818.80 (4.93%)	27.4	27.8	28.6	28.6
Child Recreation	White	107,764 (66.3%)	237,345 (61.7%)	1,870	1,890	1,930	1,930
	Black	32,768 (20.2%)	82,806.4 (21.5%)	585	593	611	612
	Hispanic	9,707 (5.97%)	26,146.2 (6.79%)	164	167	179	179
	Asian	6,673 (4.11%)	21,015.7 (5.46%)	111	114	122	123
	American Indian and Alaska Native	852 (0.525%)	2,665.04 (0.693%)	11.4	11.6	14.2	14.2
	Other	4,710 (2.90%)	14,840.4 (3.86%)	106	108	111	111

Notes:

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

b- The baseline total IQ points for each racial/ethnic population 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 child subsistence and recreational fish consumers indicates that under the baseline and regulatory options there are not disproportionately high and adverse impacts to population groups of concerns compared to the White population group (Table 25).

When evaluating results for the child subsistence fish consumer cohort under the baseline, a comparison of each population group's share of the cohort's total IQ points compared to its share of the cohort's total exposed population showed that Hispanic, Asian, American Indian and Alaska Native, and Other population groups' share of IQ points was larger than their share of the exposed population (Table 25). The Black population group's share of IQ points was smaller than its share of the exposed population, with 0.2 percent less of a share of the IQ points (Table 25). The White population group had a smaller share of IQ points compared to its share of the exposed population, with 6.7 percent less of a share of the IQ points (Table 25). The results for the child recreational fish consumer cohort under the baseline showed that, for each population group of concern, its share of IQ points was larger than its share of the exposed population (Table 25). The White population group's share of IQ points was smaller than its share of the exposed population by 4.6 percent (Table 25).

Examining the impact of the regulatory options on avoided IQ point losses in the various racial and ethnic population groups showed that for both child subsistence and recreational fish consumers cohorts, all of the regulatory options resulted in avoided IQ point losses, compared to the baseline, across the population groups (Table 25). Additionally, while the White population group received the greatest avoided IQ point losses under each of the regulatory options, this resulted in no change in the share of IQ points for each population group relative to their share of the exposed population, compared to the baseline(Table 25). Of the regulatory options, Option 4 resulted in the largest combined avoided IQ point losses compared to the baseline (Table 25).

Table 26 presents the total IQ points under the baseline and change in avoided IQ point losses under each of the regulatory options for child subsistence and recreational fish consumers, by income group (below the poverty line or not below the poverty line).

Table 26. Modeled Total IQ Points Under the Baseline and Change in Avoided IQ Point Losses under the Regulatory Options Among Child Subsistence and Recreational Fish Consumers Exposed to Mercury through Fish Consumption, by Income Group

Cohort Group	Income Group	Exposed Population[a]	Baseline Total IQ Points[b]	Option 1	Option 2	Option 3	Option 4
Child Subsistence	Below the Poverty Line	1,675 (15.0%)	11,796.6 (15.2%)	95.4	96.6	99.2	99.2
	Not Below the Poverty Line	9,473 (85.0%)	65,706.2 (84.8%)	474	481	496	496
Child Recreation	Below the Poverty Line	24,419 (15.0%)	58,722.6 (15.3%)	478	484	496	496
	Not Below the Poverty Line	138,058 (85.0%)	326,096 (84.7%)	2,370	2,400	2,480	2,480

Notes:

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

b- 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 child subsistence and recreational fish consumers indicate that under the baseline and regulatory options there are not disproportionately high and adverse impacts to those below the poverty line compared to those not below the poverty line (Table 26). An additional analysis of IQ points under the baseline and the change in avoided IQ point losses under each regulatory option for child subsistence and recreational consumer cohorts by income group, controlling for race and ethnicity, confirmed these conclusions (Appendix E, Table E-2).

The results for the child subsistence and recreational fish consumer cohorts under the baseline showed that those below the poverty line had a larger share of IQ points compared to their share of the exposed population, while those not below the poverty line had a smaller share of IQ points compared to their share of the exposed population by 0.2 and 0.3 percent, respectively (Table 26).

Examining the impact of the regulatory options on avoided IQ point losses by income group showed that for both child subsistence and recreational fish consumers cohorts, all of the regulatory options resulted in avoided IQ point losses for both those below the poverty line and those not below the poverty line, compared to the baseline (Table 26). Additionally, while under each of the regulatory options those not below the poverty line had the greatest avoided IQ point losses in absolute terms, the regulatory options resulted in no change in the share of IQ points for each income group relative to their share of the exposed population, compared to the baseline (Table 26). Of the regulatory options, Options 3 and 4 resulted in the largest combined avoided IQ point losses, compared to the baseline (Table 26).

9.2.2.3 Distribution of Health Effects Among Adults Exposed to Arsenic Through Fish Consumption

Table 27 presents the total cancer cases under the baseline and change in avoided cancer cases under each of the regulatory options for adult subsistence and recreational fish consumers, by race and ethnic population group.

Table 27. Modeled Total Cancer Cases Under the Baseline and Change in Avoided Cancer Cases under the Regulatory Options Among Adult Subsistence and Recreational Fish Consumers Exposed to Arsenic through Fish Consumption, by Racial or Ethnic Population Group

Cohort Group	Race/Ethnic Group	Exposed Population[a]	Baseline Total Cancer Cases[b]	Option 1	Option 2	Option 3	Option 4
Adult Subsistence	White	714,579 (71.2%)	40.7 (65.4%)	<1.0	<1.0	<1.0	<1.0
	Black	171,082 (17.0%)	10.4 (16.7%)	<1.0	<1.0	<1.0	<1.0
	Hispanic	47,940 (4.80%)	3.74 (6.01%)	<1.0	<1.0	<1.0	<1.0
	Asian	37,985 (3.80%)	4.01 (6.45%)	<1.0	<1.0	<1.0	<1.0
	American Indian and Alaska Native	5,352 (0.500%)	0.555 (0.892%)	<1.0	<1.0	<1.0	<1.0
	Other	26,838 (2.70%)	2.82 (4.53%)	<1.0	<1.0	<1.0	<1.0
Adult Recreation	White	10,413,558 (71.2%)	209 (67.4%)	<1.0	<1.0	<1.0	<1.0
	Black	2,493,173 (17.0%)	55.7 (18.0%)	<1.0	<1.0	<1.0	<1.0
	Hispanic	698,634 (4.80%)	16.5 (5.34%)	<1.0	<1.0	<1.0	<1.0
	Asian	553,568 (3.80%)	15.6 (5.03%)	<1.0	<1.0	<1.0	<1.0
	American Indian and Alaska Native	78,007 (0.500%)	2.15 (0.695%)	<1.0	<1.0	<1.0	<1.0
	Other	391,112 (2.70%)	11.0 (3.54%)	<1.0	<1.0	<1.0	<1.0

Notes:

a- The exposed population for each racial and ethnic population group is presented as the number of people exposed and (in parentheses) the number of people exposed as a share of the total exposed population for the entire cohort.

b- The baseline total cancer cases for each racial and ethnic population group are presented as the total number of cases for the group and (in parentheses) the total number of cases for the group as a share of the total number of cases for the entire cohort.

The results of the distributional analysis of cancer cases among both adult subsistence and recreational fish consumers indicates that under the baseline and regulatory options there are disproportionately high and adverse impacts to population groups of concern compared to the White population group (Table 27).

When evaluating results for the adult subsistence fish consumer cohort under the baseline, a comparison of each racial and ethnic population group's share of the cohort's total cancer cases compared to its share of the cohort's total exposed population showed that Hispanic, Asian, American Indian and Alaska Native, and Other population groups' share of total cancer cases was larger than its share of the exposed population (Table 27). The Black population group's share of total cancer cases was smaller than its share of the exposed population by 0.3 percent (Table 27). The White population group had a smaller share of total cancer cases compared to its share of the exposed population by 5.8 percent (Table 27). The results for the child recreational fish consumer cohort under the baseline showed that, for each population group of concern, its share of total cancer cases was larger than its share of the exposed population (Table 27). The White population group's share of total cancer cases was smaller than its share of the exposed population by 3.8 percent (Table 27).

Examining the impact of the regulatory options on avoided cancer cases in the various racial and ethnic groups showed that for both child subsistence and recreational fish consumers cohorts, all of the regulatory options resulted in avoided cancer cases across all population groups compared to the baseline (Table 27). Of the regulatory options, Option 4 resulted in the greatest combined avoided cancer cases compared to the baseline (Table 27). While the regulatory options resulted in avoided cancer cases across population groups, the absolute changes in cancer cases under each of the regulatory options did not result in a change in the distribution of the share of total cancer cases relative to the share of the total population among the population groups compared to the baseline as the changes in cancer cases were small (Table 27). Under each of the regulatory options, disproportionately high and adverse impacts were still observed among population groups of concern compared to the White population group (Table 27).

Table 28 presents the total cancer cases under the baseline and change in avoided cancer cases under each of the regulatory options for child subsistence and recreational fish consumers, by income group (below the poverty line or not below the poverty line).

Table 28. Modeled Total Cancer Cases Under the Baseline and Change in Avoided Cancer Cases under the Regulatory Options Among Adult Subsistence and Recreational Fish Consumers Exposed to Arsenic through Fish Consumption, by Income Group

Cohort Group	Income Group	Exposed Population[a]	Baseline Total Cancer Cases[b]	Option 1	Option 2	Option 3	Option 4
Adult Subsistence	Below the Poverty Line	135,371 (13.5%)	8.23 (13.2%)	<0.1	<0.1	<1.0	<1.0
	Not Below the Poverty Line	868,405 (86.5%)	54.0 (86.8%%)	<1.0	<1.0	<1.0	<1.0
Adult Recreation	Below the Poverty Line	1,972,774 (13.5%)	46.1 (13.3%)	<1.0	<1.0	<1.0	<1.0
	Not Below the Poverty Line	12,655,279 (86.5%)	269 (86.7%)	<1.0	<1.0	<1.0	<1.0

Notes:

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

b- The baseline total cancer cases for each income group are presented as the total number of cancer cases and (in parentheses) the total number of cancer cases as a share of the total number of cancer cases for the entire cohort.

The results of the distributional analysis of cancer cases among both adult subsistence and recreational fish consumers indicate that under the baseline and regulatory options there are not disproportionately high and adverse impacts to those below the poverty line compared to those not below the poverty line (Table 28). An additional analysis of cancer cases under the baseline and the change in avoided cancer cases under each regulatory option for adult subsistence and recreational consumer cohorts by income group, controlling for race and ethnicity, confirmed these conclusions (Appendix E, Table E-3).

The results for adult subsistence and recreational fish consumer cohorts under the baseline showed that that those below the poverty line had a smaller share of cancer cases compared to their share of the exposed population, while those not below the poverty line had a larger share of cancer cases compared to their share of the exposed population (Table 28).

Examining the impact of the regulatory options on avoided cancer cases in both income groups showed that for both adult subsistence and recreational fish consumers cohorts, all of the regulatory options resulted in avoided cancer cases compared to the baseline (Table 28). While those not below the poverty line received the greatest avoided cancer cases under each of the regulatory options in absolute terms, this did not result in a change in the distribution of the share of total cancer cases relative to the share of the exposed population, compared to the baseline, among the income groups as the changes in avoided cancer cases were relatively small (Table 28). Of the regulatory options, Option 4 resulted in the most combined avoided cancer cases compared to the baseline (Table 28).

9.2.2.4 Key Conclusions

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 did not show PEJC in the baseline or under the regulatory options when evaluating neurological and cognitive impacts from lead and mercury exposure among child subsistence and recreational fish consumers, both when evaluating the distribution of impacts by race and ethnic group and by income group. However, disproportionately high and adverse impacts were identified in the baseline and under the regulatory options when evaluating cancer risk impacts from arsenic exposure among adult subsistence fishers when evaluating the distribution of impacts by race and ethnic group. Such distributional impacts were not identified when evaluating the distribution of cancer risk impacts by income group. For all human health endpoints, across population groups of concern and fish consumers, EPA found that all of the regulatory options increased avoided IQ point losses and avoided cancer cases, with Option 4 producing the greatest improvements. Although, given the relatively small magnitude of these changes under the regulatory options, EPA concluded that the regulatory options do not cause PEJC relative to the baseline and, in the case of can risk impacts among adult subsistence fish consumers, do not mitigate or exacerbate PEJC under the baseline among racial and ethnic groups.

9.3 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[42, 43]. Of particular concern to EPA was 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 DBPs, including 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 2023 BCA.

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 system identified as intaking water directly or indirectly (*i.e.,* purchasing water) from surface waters receiving 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 PEJC related to exposures to TTHM and bladder cancer incidence exist under the regulatory options. The following sections present and discuss the results of these analyses.

9.3.1 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. EPA then used information from the SDWIS dataset to determine what PWS downstream of the steam electric power plants would be impacted 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 predict TTHM concentration changes. Finally, EPA estimated exposures to changes in TTHM concentrations using information on zip codes

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42. 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.

43. 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. For the purpose of 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 2023 BCA. Additionally, a distributional analysis using these results is presented in Section 9.2.

served by each system from UCMR4 and SDWIS to estimate the population served and exposed to TTHM through drinking water. For a more detailed discussion of EPA methodology for estimating TTHM exposures, see Section 4 of the 2023 BCA.

The results of the analysis are presented in Table 29. Given the number of systems that EPA identified as being potentially impacted by bromide discharges, changes in TTHM concentrations are presented at the state level for ease of comprehension. Therefore, changes in TTHM concentrations presented in Table 29 were calculated by weighting the modeled changes in TTHM concentrations under each of the regulatory options across all affected drinking water systems in each state based on the population served. Information on changes in TTHM concentrations under each of the regulatory options is combined with information on socioeconomic characteristics of the exposed populations collected from the U.S. Census Bureau's 2015 to 2019 ACS dataset to facilitate assessment of distributional impacts.

Table 29. 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 American Indian/Alaska Native [a]	Percent Asian [a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent Other [a]	Percent Hispanic/ Latino[a]	Option 1		Option 2		Option 3		Option 4	
										ΔTTHM (μg/L)[b]	PWS (#)	ΔTTHM (μg/L)[b]	PWS (#)	ΔTTHM (μg/L)[b]	PWS (#)	ΔTTHM (μg/L)[b]	PWS (#)
AL	81	2,008,103	16.6%	23.2%	0.5%	1.4%	0.1%	2.3%	5.7%	0	0	-5.6	27	-5.7	27	-18	29
AZ	9	14,815	15.9%	2.9%	34.6%	0.8%	0.2%	1.9%	22.1%	0	0	0	10	<-1.0	10	<-1.0	10
CA	96	12,191,421	13.4%	6.4%	0.2%	14.9%	0.3%	2.8%	43.3%	0	0	0	96	<-1.0	96	<-1.0	96
DC	2	632,323	14.3%	39.5%	0.2%	5.4%	0.1%	3.0%	9.9%	0	0	0	0	<-1.0	2	<-1.0	2
GA	14	643,252	20.1%	39.3%	0.3%	1.3%	0.0%	2.3%	8.8%	0	0	-1.9	2	-2.0	2	-2.0	2
IA	3	159,823	13.4%	7.5%	0.2%	2.8%	0.0%	2.9%	6.5%	0	0	<-1.0	2	<-1.0	3	<-1.0	3
IL	31	549,576	14.5%	16.8%	0.2%	1.6%	0.0%	2.4%	6.1%	0	0	0	0	-11	24	-11	31
IN	5	200,792	34.3%	33.5%	0.4%	0.1%	1.0%	4.4%	4.9%	0	0	-8.3	5	-8.3	5	-8.4	5
KS	12	168,609	10.9%	7.2%	0.7%	1.3%	0.0%	3.1%	10.5%	0	0	-23	12	-23	12	-23	12
KY	38	349,733	18.4%	5.4%	0.1%	0.6%	0.0%	1.9%	4.5%	0	0	-11	14	-11	14	-11	27
LA	18	968,256	18.7%	40.0%	0.3%	3.2%	0.0%	2.0%	9.9%	0	0	-12.3	18	-12.3	18	-12.4	18
MA	10	358,066	13.3%	3.8%	0.2%	9.5%	0.0%	1.9%	29.0%	-5.3	10	-5.3	10	-5.4	10	-5.4	10
MD	19	3,936,765	10.9%	39.0%	0.2%	8.0%	0.1%	3.2%	12.0%	0	0	0	0	<-1.0	11	<-1.0	11
MN	9	667,615	15.4%	15.8%	0.8%	5.4%	0.0%	3.9%	8.3%	0	0	0	0	<-1.0	9	<-1.0	9
MO	19	1,824,039	10.7%	23.0%	0.1%	3.7%	0.0%	2.5%	3.0%	0	0	-24	19	-24	19	-24	19
NC	37	1,337,529	13.6%	57.9%	0.1%	2.0%	0.0%	2.5%	7.5%	0	0	0	0	<-1.0	36	-17	36
ND	11	33,052	7.6%	1.3%	3.3%	0.7%	0.0%	2.1%	3.2%	0	0	-7.7	12	-7.7	12	-7.7	12
NE	9	13,097	8.1%	0.8%	0.1%	0.2%	0.1%	1.2%	2.7%	0	0	-4.6	9	-4.6	9	-4.6	9
NH	1	87,932	10.8%	3.0%	0.1%	7.6%	0.0%	2.9%	15.1%	<-1.0	1	<-1.0	1	<-1.0	1	<-1.0	1
NV	8	2,174,286	14.4%	11.2%	0.4%	9.0%	0.6%	4.0%	32.5%	0	0	0	0	<-1.0	7	<-1.0	8
OH	19	109,283	23.4%	6.1%	0.3%	1.0%	0.0%	2.9%	2.4%	0	0	-5.0	19	-5.1	19	-5.8	19
OK	20	33,187	22.2%	1.1%	31.0%	0.8%	0.2%	9.6%	6.3%	0	0	0	0	<-1.0	20	<-1.0	20
PA	68	3,598,707	12.0%	11.9%	0.1%	3.9%	0.0%	2.5%	5.7%	0	0	-7.4	40	-7.6	40	-7.6	40

Table 29. 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 American Indian/Alaska Native [a]	Percent Asian [a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent Other [a]	Percent Hispanic/ Latino[a]	Option 1		Option 2		Option 3		Option 4	
										ΔTTHM (µg/L)[b]	PWS (#)	ΔTTHM (µg/L)[b]	PWS (#)	ΔTTHM (µg/L)[b]	PWS (#)	ΔTTHM (µg/L)[b]	PWS (#)
SC	43	473,094	13.0%	22.6%	0.5%	1.5%	0.1%	2.6%	4.8%	0	0	0	0	<-1.0	18	-4.1	18
SD	98	135,807	14.9%	1.0%	11.1%	1.9%	0.1%	2.1%	3.6%	0	0	-82	106	-82	106	-82	106
TN	43	2,113,168	12.4%	16.6%	0.2%	2.7%	0.1%	2.6%	7.5%	0	0	0	0	0	0	<-1.0	28
VA	35	3,090,649	7.5%	15.7%	0.2%	12.4%	0.1%	4.2%	14.5%	0	0	0	0	<-1.0	34	-7.0	35
WV	21	256,821	19.6%	3.9%	0.1%	2.1%	0.0%	2.9%	2.3%	0	0	-3.5	8	-3.8	21	-4.2	21
Total	**779**	**38,129,800**								**-6.3**	**11**	**-203.6**	**410**	**-225.5**	**585**	**-265.2**	**637**
US			**13.7%**	**12.2%**	**0.7%**	**5.4%**	**0.2%**	**2.7%**	**18.8%**								

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 ZCTAs 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. The change in TTHM concentration was weighted by the populations of the potentially affected PWS in each state.

c) Delaware and Mississippi each had one downstream PWS, but neither was estimated to be impacted by any regulatory option for TTHM concentrations.

The results of EPA's analysis showed that, across all states and affected systems, all of the regulatory options resulted in a decrease in the concentration of TTHM in drinking water (Table 29).

Under Option 1, reductions in TTHM concentrations are observed across 11 systems in two states – Massachusetts and New Hampshire (Table 29). Populations served by potentially affected systems in Massachusetts have larger proportions of Asian (non-Hispanic) and Hispanic or Latino people than the national average (Table 29). Additionally, populations served by potentially affected systems in New Hampshire have larger proportions of Asian (non-Hispanic) and Other (non-Hispanic) people than the national average (Table 29).

Option 2 results in reductions in TTHM concentrations across 410 systems in 16 states (Table 29). Of these 16 states, 14 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 (Table 29). For five states which have one population group of concern above the national average, the median change in TTHM concentrations observed under Option 2 is about -11µg/L (Table 29). Across eight states which have two population groups of concern above the national average, the median change in TTHM concentrations observed under Option 2 is about -4.4µg/L (Table 29). Lastly, for one state which has three or more population groups of concern above the national average, the change in TTHM concentrations observed under Option 2 is about -8.3µg/L (Table 29).

Under Option 3, reductions in TTHM concentrations are observed across 585 systems in 27 states (Table 29). Of these 27 states, 25 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 (Table 29). For seven states which have one population group of concern above the national average, the median change in TTHM concentrations observed under Option 3 is about -7.7µg/L (Table 29). Across nine states which have two population groups of concern above the national average, the median change in TTHM concentrations observed under Option 3 is about -5.4µg/L (Table 29). Lastly, for nine states which have three or more population groups of concern above the national average, the change in TTHM concentrations observed under Option 3 is about -1µg/L (Table 29).

Option 4 results in reductions in TTHM concentrations in 637 systems across all 28 states with potentially affected systems. Of these states, 26 have populations served by affected systems where the percent of the populations for at least one population group of concern is above the national average (Table 29). For eight states which have one population group of concern above the national average, the median change in TTHM concentrations observed under Option 4 is about -9.3µg/L (Table 29). Across nine states which have two population groups of concern above the national average, the median change in TTHM concentrations observed under Option 4 is about -5.4µg/L (Table 29). Finally, for nine states which have three or more population groups of concern above the national average, the median change in TTHM concentrations observed under Option 4 is about -1µg/L (Table 29).

9.3.2 Distribution of Bladder Cancer Cases 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 proposed rule-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 2023 BCA.

The results of the analysis are presented in Table 30 and Table 31. Given the number of systems that EPA identified as being potentially impacted by changes in bromide discharges, changes in bladder cancer incidence and mortality are presented at the state level for ease of comprehension. Similar to the analysis of changes in TTHM concentration, information on changes in bladder cancer incidence and mortality under each of the regulatory options is combined with information on socioeconomic characteristics of the exposed populations collected from the U.S. Census Bureau's 2015 to 2019 ACS dataset to facilitate assessment of distributional impacts.

Table 30. 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 American Indian/ Alaska Native[a]	Percent Asian[a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent Other[a]	Percent Hispanic/ Latino[a]	Option 1		Option 2		Option 3		Option 4	
										Cases Avoided (#)[b]	PWS (#)	Cases Avoided (#)[b]	PWS (#)	Cases Avoided (#)[b]	PWS (#)	Cases Avoided (#)[b]	PWS (#)
AL	81	2,008,103	16.6%	23.2%	0.5%	1.4%	0.1%	2.3%	5.7%	0	0	1.5	9	1.6	9	15	12
CA	96	12,191,421	13.4%	6.4%	0.2%	14.9%	0.3%	2.8%	43.3%	0	0	0	0	<1.0	1	<1.0	1
DC	2	632,323	14.3%	39.5%	0.2%	5.4%	0.1%	3.0%	9.9%	0	0	0	0	<1.0	1	<1.0	1
GA	14	643,252	20.1%	39.3%	0.3%	1.3%	0.0%	2.3%	8.8%	0	0	1.8	2	1.9	2	1.9	2
IL	31	549,576	14.5%	16.8%	0.2%	1.6%	0.0%	2.4%	6.1%	0	0	5.3	11	5.3	11	5.3	11
IN	5	200,792	34.3%	33.5%	0.4%	0.1%	1.0%	4.4%	4.9%	0	0	7.3	5	7.4	5	7.4	5
KS	12	168,609	10.9%	7.2%	0.7%	1.3%	0.0%	3.1%	10.5%	0	0	9.7	7	9.7	7	9.7	7
KY	38	349,733	18.4%	5.4%	0.1%	0.6%	0.0%	1.9%	4.5%	0	0	3	10	3	10	3.2	11
LA	18	968,256	18.7%	40.0%	0.3%	3.2%	0.0%	2.0%	9.9%	0	0	14	15	14	15	14	15
MA	10	358,066	13.3%	3.8%	0.2%	9.5%	0.0%	1.9%	29.0%	4.0	8	4.0	8	4.1	8	4.1	8
MD	19	3,936,765	10.9%	39.0%	0.2%	8.0%	0.1%	3.2%	12.0%	0	0	0	0	<1.0	1	<1.0	1
MO	19	1,824,039	10.7%	23.0%	0.1%	3.7%	0.0%	2.5%	3.0%	0	0	44	15	44	15	44	15
NC	37	1,337,529	13.6%	57.9%	0.1%	2.0%	0.0%	2.5%	7.5%	0	0	0	0	<1.0	1	17	12
ND	11	33,052	7.6%	1.3%	3.3%	0.7%	0.0%	2.1%	3.2%	0	0	<1.0	4	<1.0	4	<1.0	4
NE	9	13,097	8.1%	0.8%	0.1%	0.2%	0.1%	1.2%	2.7%	0	0	0.1	1	0.1	1	0.1	1
NH	1	87,932	10.8%	3.0%	0.1%	7.6%	0.0%	2.9%	15.1%	1.3	1	1.3	1	1.3	1	1.3	1
OH	19	109,283	23.4%	6.1%	0.3%	1.0%	0.0%	2.9%	2.4%	0	0	<1.0	2	<1.0	2	<1.0	2
PA	68	3,598,707	12.0%	11.9%	0.1%	3.9%	0.0%	2.5%	5.7%	0	0	11	14	12	14	12	14
SC	43	473,094	13.0%	22.6%	0.5%	1.5%	0.1%	2.6%	4.8%	0	0	0	0	0	0	1.6	8
SD	98	135,807	14.9%	1.0%	11.1%	1.9%	0.1%	2.1%	3.6%	0	0	1.6	12	1.6	12	1.6	12
VA	35	3,090,649	7.5%	15.7%	0.2%	12.4%	0.1%	4.2%	14.5%	0	0	0	0	0.3	3	4.0	9
WV	21	256,821	19.6%	3.9%	0.1%	2.1%	0.0%	2.9%	2.3%	0	0	1.6	3	1.6	3	1.9	3
Total	687	32,966,906								5.3	9	108.2	119	113.9	126	149.1	155

Table 30. 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 American Indian/ Alaska Native[a]	Percent Asian[a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent Other[a]	Percent Hispanic/ Latino[a]	Option 1		Option 2		Option 3		Option 4	
										Cases Avoided (#)[b]	PWS (#)	Cases Avoided (#)[b]	PWS (#)	Cases Avoided (#)[b]	PWS (#)	Cases Avoided (#)[b]	PWS (#)
US			13.7%	12.2%	0.7%	5.4%	0.2%	2.7%	18.8%								

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 ZCTAs 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.

c) Arizona, Delaware, Iowa, Minnesota, Mississippi, Nevada, Oklahoma, and Tennessee had 94 PWSs with very small changes in TTHM concentrations that resulted in no estimated changes in bladder cancer cases under any regulatory option.

The results of EPA's analysis showed that across all states and affected, all of the regulatory options result in increases in the number of bladder cancer cases avoided over the period of analysis (Table 30).

Under Option 1, increases in the number of bladder cancer cases avoided are observed across nine systems in two states–Massachusetts and New Hampshire (Table 30). Populations served by potentially affected systems in Massachusetts have larger proportions of Asian (non-Hispanic) and Hispanic or Latino people than the national average (Table 30). Additionally, populations served by potentially affected systems in New Hampshire have larger proportions of Asian (non-Hispanic) and Other (non-Hispanic) people than the national average (Table 30).

Option 2 results in increases in bladder cancer cases avoided across 119 systems in 16 states (Table 30). Of these 16 states, 14 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 (Table 30). For four states which have one population group of concern above the national average, the median change in bladder cancer cases avoided observed under Option 2 is about 6.35 cases (Table 30). Across nine states which have two population groups of concern above the national average, the median change in bladder cancer cases avoided observed under Option 2 is about 1.6 cases (Table 30). Lastly, for one state which has three or more population groups of concern above the national average, the change in bladder cancer cases avoided observed under Option 2 is about 7.3 cases (Table 30).

Under Option 3, increases in bladder cancer cases avoided are observed across 126 systems in 21 states (Table 30). Of these 21 states, 19 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 (Table 30). For five states which have one population group of concern above the national average, the median change in bladder cancer cases avoided observed under Option 3 is about three cases (Table 30). Across nine states which have two population groups of concern above the national average, the median change in bladder cancer cases avoided observed under Option 3 is about 1.6 cases (Table 30). Lastly, for five states which have three or more population groups of concern above the national average, the median change in bladder cancer cases avoided observed under Option 3 is about one case (Table 30).

Option 4 results in increases in the number of bladder cancer cases avoided across 155 systems in all 22 states with potentially affected systems (Table 30). Of these states, 20 have populations served by affected systems where the percent of the populations for at least one population group of concern is above the national average (Table 30). For six states which have one population group of concern above the national average, the median change in bladder cancer cases avoided observed under Option 4 is about 6.45 cases (Table 30). Across eight states which have two population groups of concern above the national average, the median change in bladder cancer cases avoided observed under Option 4 is about 1.9 cases (Table 30). Finally, for five states which have three or more population groups of concern above the national average, the median change in bladder cancer cases avoided observed under Option 4 is about one case (Table 30).

Table 31. 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 American Indian/ Alaska Native[a]	Percent Asian[a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent Other[a]	Percent Hispanic/ Latino[a]	Option 1		Option 2		Option 3		Option 4	
										Deaths Avoided (#)[b]	PWS (#)	Deaths Avoided (#)[b]	PWS (#)	Deaths Avoided (#)[b]	PWS (#)	Deaths Avoided (#)[b]	PWS (#)
AL	81	2,008,103	16.6%	23.2%	0.5%	1.4%	0.1%	2.3%	5.7%	0	0	<1.0	6	<1.0	6	4.3	8
DC	2	632,323	14.3%	39.5%	0.2%	5.4%	0.1%	3.0%	9.9%	0	0	0	0	<1.0	1	<1.0	1
GA	14	643,252	20.1%	39.3%	0.3%	1.3%	0.0%	2.3%	8.8%	0	0	<1.0	2	<1.0	2	<1.0	2
IL	31	549,576	14.5%	16.8%	0.2%	1.6%	0.0%	2.4%	6.1%	0	0	1.4	7	1.4	7	1.4	7
IN	5	200,792	34.3%	33.5%	0.4%	0.1%	1.0%	4.4%	4.9%	0	0	2.0	3	2.0	3	2.0	3
KS	12	168,609	10.9%	7.2%	0.7%	1.3%	0.0%	3.1%	10.5%	0	0	2.6	4	2.6	4	2.6	4
KY	38	349,733	18.4%	5.4%	0.1%	0.6%	0.0%	1.9%	4.5%	0	0	0.7	5	0.7	5	0.8	5
LA	18	968,256	18.7%	40.0%	0.3%	3.2%	0.0%	2.0%	9.9%	0	0	3.7	9	3.7	9	3.8	9
MA	10	358,066	13.3%	3.8%	0.2%	9.5%	0.0%	1.9%	29.0%	1.1	6	1.1	6	1.1	6	1.1	6
MD	19	3,936,765	10.9%	39.0%	0.2%	8.0%	0.1%	3.2%	12.0%	0	0	0	0	0.1	1	0.1	1
MO	19	1,824,039	10.7%	23.0%	0.1%	3.7%	0.0%	2.5%	3.0%	0	0	0	0	12	11	12	11
NC	37	1,337,529	13.6%	57.9%	0.1%	2.0%	0.0%	2.5%	7.5%	0	0	0	0	<1.0	1	4.7	6
ND	11	33,052	7.6%	1.3%	3.3%	0.7%	0.0%	2.1%	3.2%	0	0	<1.0	1	<1.0	1	<1.0	1
NH	1	87,932	10.8%	3.0%	0.1%	7.6%	0.0%	2.9%	15.1%	<1.0	1	<1.0	1	<1.0	1	<1.0	1
OH	19	109,283	23.4%	6.1%	0.3%	1.0%	0.0%	2.9%	2.4%	0	0	<1.0	2	<1.0	2	<1.0	2

Table 31. 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 American Indian/ Alaska Native[a]	Percent Asian[a]	Percent Native Hawaiian/ Pacific Islander[a]	Percent Other[a]	Percent Hispanic/ Latino[a]	Option 1		Option 2		Option 3		Option 4	
										Deaths Avoided (#)[b]	PWS (#)	Deaths Avoided (#)[b]	PWS (#)	Deaths Avoided (#)[b]	PWS (#)	Deaths Avoided (#)[b]	PWS (#)
PA	68	3,598,707	12.0%	11.9%	0.1%	3.9%	0.0%	2.5%	5.7%	0	0	2.9	7	3.0	7	3.0	7
SC	43	473,094	13.0%	22.6%	0.5%	1.5%	0.1%	2.6%	4.8%	0	0	0	0	0	0	<1.0	2
SD	98	135,807	14.9%	1.0%	11.1%	1.9%	0.1%	2.1%	3.6%	0	0	<1.0	3	<1.0	3	<1.0	3
VA	35	3,090,649	7.5%	15.7%	0.2%	12.4%	0.1%	4.2%	14.5%	0	0	0	0	0	0	1.0	4
WV	21	256,821	19.6%	3.9%	0.1%	2.1%	0.0%	2.9%	2.3%	0	0	<1.0	1	<1.0	1	<1.05	2
Total	582	20,762,388								2.1	7	21.4	57	35.6	71	44.85	85
US			13.7%	12.2%	0.7%	5.4%	0.2%	2.7%	18.8%								

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 ZCTAs 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.

c) California and Nebraska had 105 PWS with very small cancer cases avoided that resulted in no deaths avoided for any regulatory option.

The results of EPA's analysis showed that, across all states, all of the regulatory options result in increases in excess bladder cancer deaths avoided (Table 31).

Under Option 1, increases in the number of excess bladder cancer deaths avoided are observed across seven systems in two states–Massachusetts and New Hampshire (Table 31). Populations served by potentially affected systems in Massachusetts have larger proportions of Asian (non-Hispanic) and Hispanic or Latino people than the national average (Table 31). Additionally, populations served by potentially affected systems in New Hampshire have larger proportions of Asian (non-Hispanic) and Other (non-Hispanic) people than the national average (Table 31).

Option 2 results in increases in excess bladder cancer deaths avoided across 57 systems in 14 states (Table 31). Of these 14 states, 13 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 (Table 31). For three states which have one population group of concern above the national average, the median change in excess bladder cancer deaths avoided observed under Option 2 is about one death (Table 31). Across nine states which have two population groups of concern above the national average, the median change in excess bladder cancer deaths avoided observed under Option 2 is about one death (Table 31). Lastly, for one state which has three or more population groups of concern above the national average, the change in excess bladder cancer deaths avoided observed under Option 2 is about two deaths (Table 31).

Under Option 3, increases in excess bladder cancer deaths avoided are observed across 71 systems in 18 states (Table 31). Of these 18 states, 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 (Table 31). For five states which have one population group of concern above the national average, the median change in excess bladder cancer deaths avoided observed under Option 3 is about one death (Table 31). Across nine states which have two population groups of concern above the national average, the median change in excess bladder cancer deaths avoided observed under Option 3 is about one death (Table 31). Lastly, for three states which have three or more population groups of concern above the national average, the median change in excess bladder cancer deaths avoided observed under Option 3 is about one death (Table 31).

Option 4 results in increases in the number of excess bladder cancer deaths avoided across 85 systems in all 20 states with potentially affected systems (Table 31). Of these states, 19 have populations served by affected systems where the percent of the populations for at least one population group of concern is above the national average (Table 31). For six states which have one population group of concern above the national average, the median change in excess bladder cancer deaths avoided observed under Option 4 is about 1.8 deaths (Table 31). Across 10 states which have two population groups of concern above the national average, the median change in excess bladder cancer deaths avoided observed under Option 4 is about 1.03 deaths (Table 31). Finally, for three states which have three or more population groups of concern above the national average, the median change in excess bladder cancer deaths avoided observed under Option 4 is about one deaths (Table 31).

9.3.3 Key Conclusions

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, showed that, across all of the analyses, that all of the regulatory options result in a decrease in TTHM concentrations and increases in bladder cancer cases and excess bladder cancer deaths avoided in states with affected drinking water systems. Of the regulatory options evaluated, across the analyses and states with affected systems, EPA concluded that Option 4 generated the greatest improvements. Across the analyses, under each of the regulatory options, the majority of states with affected systems served populations with at least one population group of concern above the national average, with the largest proportion of these states having two population groups of concern above the national average. Analyzing the distribution of changes across the analyses and regulatory options, EPA found that states with affected systems serving populations with one population group of concern above the national average experienced the largest median changes in

TTHM concentrations and bladder cancer cases and excess bladder cancer deaths avoided than states serving populations with two and three or more population groups of concern above the national average, respectively. While the magnitude of the median change observed across the analyses decreased with the more stringent regulatory options in communities with one, two, or three or more population groups of concern above the national average, EPA found that this was not due to a there being fewer reductions in TTHM concentrations and increases in bladder can cases and excess bladder cancer deaths avoided with more stringent options, but rather that more new states with affected systems experiencing smaller changes were being added under the more stringent options. Therefore, EPA concluded that Option 4 still generated the greatest improvements. Given that the analysis focused on changes under the regulatory options, EPA could not draw conclusions with respect to how the magnitude and distribution of improvements under the regulatory options affects the baseline distribution of exposures to TTHM and the incidence of bladder cancer cases and deaths among population groups of concern.

9.4 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 9.2), 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.

To analyze the human health effects caused by exposures to multiple pollutants, EPA used a three-tiered framework developed by the Agency for Toxic Substances and Disease Registry (ATSDR) for evaluating the joint toxic action (JTA) of multiple pollutants. For more information on the methodology EPA used to perform the JTA analysis, see the EPA memorandum *Methodology for Assessing Human Health Impacts from Multiple Pollutants in Steam Electric Power Plant Discharges* (U.S. EPA, 2023g).

In Tier 1, potential human health impacts are evaluated for individual pollutants within a mixture using the HQ[44] method or by calculating a cancer risk estimate (CRE)[45] (ATSDR, 2018). For more information on the results of EPA's Tier 1 analysis, see the 2023 EA.

In Tier 2, individual pollutants with an HQ greater than or equal to 0.1 or a CRE greater than or equal to 10^{-6} are considered to pose a potential threat to human health and are retained for the Tier 2 analysis (ATSDR, 2018).Given that arsenic was the only pollutant evaluated in the 2023 EA IRW human health module with a published cancer slope factor, EPA did not perform a JTA analysis on potential cumulative cancer risk from steam electric power plant discharges. Potential cumulative risks were only evaluated for non-cancer human health effects. Next, a preliminary assessment is conducted for evaluating the potential for JTA among multiple pollutants in a mixture. A preliminary Hazard Index (HI) is calculated as the sum of the HQs for the remaining pollutants within a mixture. A preliminary HI greater than 1 indicates the potential for human health impacts caused by additive effects of the pollutants within the mixture. Tier 3 further refines the assessment in Tier 2 to a specific health effect from a common mode of action and duration. For more information on the results of EPA's Tier 2 analysis, see the 2023 EA.

44. HQs are calculated as the ratio of the exposure estimate to an established human health-based metric like an ATSDR MRL or an EPA RfD value.

45. CREs are calculated as by multiplying the exposure estimate by and EPA cancer slope factor.

In the Tier 3 analysis, benchmark values (*i.e.,* RfD, minimal risk level [MRL], and target organ toxicity dose [TTD]) established for similar health effects and modes of action are used[46] to calculate human health endpoint-specific HQ values. Endpoint specific values are then summed to calculate a human health endpoint-specific HI value. A human health endpoint-specific HI greater than 1 indicates a potential human health impact due to the assumption of dose additivity of the pollutants within the mixture (ATSDR, 2004a). Lastly, ATSDR recommends using a qualitative binary weight-of-evidence (BINWOE) assessment for evaluating interactions among pollutant pairs in a mixture. The results of the BINWOE analysis provide an indication of the direction of a given interaction among pollutants and assigns qualitative statements to the human health endpoint-specific HI like greater than additive, additive, less than additive, and indeterminate. BINWOE factors for pollutant pairs included in the Tier 3 analysis are summed to determine whether the potential for a health effect may be greater or less than what is predicted based on the endpoint-specific HI alone. Positive combined BINWOE scores that are significantly different than zero indicate that the mixture is likely to pose a greater hazard than indicated by an HI alone. Negative combined BINWOE scores that are significantly different from zero suggest that the mixture poses less of a hazard than indicated by the endpoint-specific HI alone. Combined BINWOE scores of zero or close to zero indicate the endpoint-specific HI is a reasonable prediction of the potential threat posed by the mixture (ATSDR, 2004a).

ATSDR has developed 12 final and three draft interaction profiles that describe the potential human health effects of JTA of pollutants in a mixture. Of these interaction profiles, EPA reviewed three for incorporation into the analysis: *Interaction Profile for Arsenic, Cadmium, Chromium, and Lead*; *Interaction Profile for Lead, Manganese, Zinc, and Copper*; *and Interaction Profile for Chlorpyrifos, Lead, Mercury, and Methylmercury* (ATSDR, 2004b, 2004c, 2006). Based on human health effects module of the IRW Model EPA used to assess human health effects from fish consumption in the EA, EPA identified five pollutants for consideration in the JTA analysis: arsenic, cadmium, lead, zinc, and methylmercury. Using the health endpoint-specific benchmarks included in the ATSDR interaction profiles, EPA identified five human health effects to include in the JTA analysis: neurological, renal, cardiovascular, hematological, and testicular.

The JTA analysis was performed at the immediate receiving water level under the baseline and each of the regulatory options, the results of which are presented and discussed below. Included with the results is information on the socioeconomic characteristics of communities with immediate receiving waters with and without mixture- and health endpoint-specific HI exceedances under the baseline and regulatory options. This was done to facilitate a distributional assessment of cumulative risks to determine whether PEJC exist under the baseline and/or regulatory options.

9.4.1 Distribution of Cumulative Risks among Affected Communities

For the Tier 2 analysis, EPA calculated human health endpoint-specific HQ values for the five pollutants previously discussed under the baseline and each of the four regulatory options. HQs were calculated for each immediate receiving water and each consumer cohort group (child subsistence, child recreational, adult subsistence, adult recreational). Immediate receiving waters with two or more pollutants where the HQ from the Tier 2 analysis was greater than or equal to 0.1 are included in the Tier 3 analysis. As noted earlier, EPA did not identify any immediate receiving waters where arsenic exceeded the HQ value of 0.1.

For the Tier 3 analysis, EPA calculated human health endpoint-specific HI values under the baseline and each of the four regulatory options for three mixtures of concern identified from the Tier 2 results: Arsenic-Cadmium-Lead (As-Cd-Pb), Zinc-Lead (Zn-Pb), and Methylmercury-Lead (MeHg-Pb). Within each consumer cohort, HI values were calculated for each immediate receiving water where multiple pollutants exceeded an HQ of 0.1. Information on the socioeconomic characteristics of communities with

46. A RfD or MRL value is used when the critical effect is equal to the human health effect being evaluated in the hazard index. A TTD value is used when the pollutant is known to cause an effect of concern at a concentration greater than the critical effect associated with the pollutant's RfD or MRL value (ATSDR, 2004a).

affected immediate receiving waters was included to facilitate a distributional analysis of human health impacts from exposures to multiple pollutants in steam electric power plant discharges. The results of the analysis are presented in Table 32a-Table 32f.

Table 32a. Immediate Receiving Water Community Demographics by Joint Toxic Action Hazard Index Exceedances[a] for Cardiovascular Impacts Under Baseline and the Regulatory Options for Arsenic-Cadmium-Lead Mixtures, Organized by Age and Fishing Mode Cohort[b]

Demographics	National Average	Baseline		Options 1 through 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Child, Subsistence Fisher					
Percent Low-Income	**13.7%**	1.1%	5.7%	Not applicable (NA)	5.7%
Percent African American (non-Hispanic)	**12.2%**	0%	7.7%	NA	7.7%
Percent American Indian/Alaska Native	**0.7%**	0%	1.3%	NA	1.3%
Percent Asian	**5.4%**	1.8%	2.0%	NA	2.0%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0%	0.1%	NA	0.1%
Percent Other (non-Hispanic)	**2.7%**	0.4%	2.4%	NA	2.4%
Percent Hispanic/Latino	**18.8%**	0%	5.7%	NA	5.6%
Total Population		1,687	265,971	0	267,658
Count of IRW		1	97	0	98

Source: 2023 EA

Abbreviations: IRW (immediate receiving water); NA (not applicable).

a – EPA assessed human health impacts from the joint toxic action of multiple pollutants in steam electric power plant discharges, calculating a hazard index (HI) based on individual pollutant hazard quotients to determine exceedances of HI > 1.0. See the 2023 EA for more details on the analysis.

b – Lead blood levels only available for child cohorts. No exceedances under baseline or the regulatory options for child (recreational), adult (recreational), or adult (subsistence) fishers.

Table 32b. Immediate Receiving Water Community Demographics by Joint Toxic Action Hazard Index Exceedances[a] for Hematological Impacts Under Baseline and the Regulatory Options for Arsenic-Cadmium-Lead Mixtures, Organized by Age and Fishing Mode Cohort[b]

Demographics	National Average	Baseline		Option 1		Options 2 through 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Child, Recreational Fisher							
Percent Low-Income	13.7%	1.1%	5.7%	1.1%	5.7%	1.1%	5.7%
Percent African American (non-Hispanic)	12.2%	0%	7.7%	0%	7.7%	0%	7.7%
Percent American Indian/Alaska Native	0.7%	0%	1.3%	0%	1.3%	0%	1.3%
Percent Asian	5.4%	1.8%	2.0%	1.8%	2.0%	1.8%	2.0%
Percent Native Hawaiian/Pacific Islander	0.2%	0%	0.1%	0%	0.1%	0%	0.1%
Percent Other (non-Hispanic)	2.7%	0.4%	2.4%	0.4%	2.4%	0.4%	2.4%
Percent Hispanic/Latino	18.8%	0%	5.7%	0%	5.7%	0%	5.7%
Total Population		1,687	265,971	1,687	265,971	1,687	265,971
Count of IRW		1	97	1	97	1	97
Child, Subsistence Fisher							
Percent Low-Income	13.7%	7.6%	5.6%	1.6%	5.8%	1.1%	5.7%
Percent African American (non-Hispanic)	12.2%	13.6%	7.3%	0%	7.7%	0%	7.7%
Percent American Indian/Alaska Native	0.7%	0.2%	1.4%	0.6%	1.3%	0%	1.3%
Percent Asian	5.4%	1.9%	2.0%	1.0%	2.0%	1.8%	2.0%
Percent Native Hawaiian/Pacific Islander	0.2%	0.3%	0.1%	0%	0.1%	0%	0.1%
Percent Other (non-Hispanic)	2.7%	3.4%	2.4%	3.0%	2.4%	0.4%	2.4%

Table 32b. Immediate Receiving Water Community Demographics by Joint Toxic Action Hazard Index Exceedances[a] for Hematological Impacts Under Baseline and the Regulatory Options for Arsenic-Cadmium-Lead Mixtures, Organized by Age and Fishing Mode Cohort[b]

Demographics	National Average	Baseline		Option 1		Options 2 through 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Percent Hispanic/Latino	18.8%	4.4%	5.7%	4.3%	5.6%	0%	5.7%
Total Population		16,060	251,598	3,008	264,650	1,687	265,971
Count of IRW		8	90	2	96	1	97

Source: 2023 EA

Abbreviations: IRW (immediate receiving water).

a – EPA assessed human health impacts from the joint toxic action of multiple pollutants in steam electric power plant discharges, calculating a hazard index (HI) based on individual pollutant hazard quotients to determine exceedances of HI > 1.0. See the 2023 EA for more details on the analysis.

b – Lead blood levels only available for child cohorts. No exceedances under baseline or the regulatory options for adult (recreational) or adult (subsistence) fishers.

Table 32c. Immediate Receiving Water Community Demographics by Joint Toxic Action Hazard Index Exceedances[a] for Hematological Impacts Under Baseline and the Regulatory Options for Zinc-Lead Mixtures, Organized by Age and Fishing Mode Cohort[b]

Demographics	National Average	Baseline		Options 1 through 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Child, Subsistence Fisher					
Percent Low-Income	**13.7%**	1.1%	5.7%	Not applicable (NA)	5.7%
Percent African American (non-Hispanic)	**12.2%**	0%	7.7%	NA	7.7%
Percent American Indian/Alaska Native	**0.7%**	0%	1.3%	NA	1.3%
Percent Asian	**5.4%**	1.8%	2.0%	NA	2.0%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0%	0.1%	NA	0.1%
Percent Other (non-Hispanic)	**2.7%**	0.4%	2.4%	NA	2.4%
Percent Hispanic/Latino	**18.8%**	0%	5.7%	NA	5.6%
Total Population		1,687	265,971	0	267,658
Count of IRW		1	97	0	98

Source: 2023 EA

Abbreviations: IRW (immediate receiving water); NA (not applicable).

a – EPA assessed human health impacts from the joint toxic action of multiple pollutants in steam electric power plant discharges, calculating a hazard index (HI) based on individual pollutant hazard quotients to determine exceedances of HI > 1.0. See the 2023 EA for more details on the analysis.

b – Lead blood levels only available for child cohorts. Joint toxic action analysis limited to child (recreational) and child (subsistence) cohorts. No exceedances under baseline or the regulatory options for child (recreational) fishers.

Table 32d. Immediate Receiving Water Community Demographics by Joint Toxic Action Hazard Index Exceedances[a] for Neurological Impacts Under Baseline and the Regulatory Options for Arsenic-Cadmium-Lead Mixtures, Organized by Age and Fishing Mode Cohort[b]

Demographics	National Average	Baseline		Option 1		Option 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Child, Recreational Fisher									
Percent Low-Income	13.7%	6.4%	5.7%	8.1%	5.6%	9.2%	5.6%	9.2%	5.6%
Percent African American (non-Hispanic)	12.2%	12.4%	7.2%	21.2%	7.2%	25.2%	7.2%	25.2%	7.2%
Percent American Indian/Alaska Native	0.7%	0.2%	1.4%	0.5%	1.3%	0.3%	1.3%	0.3%	1.3%
Percent Asian	5.4%	1.5%	2.0%	0.8%	2.0%	0.9%	2.0%	0.9%	2.0%
Percent Native Hawaiian/Pacific Islander	0.2%	0.2%	0.1%	0.5%	0.1%	0.6%	0.1%	0.6%	0.1%
Percent Other (non-Hispanic)	2.7%	3.6%	2.3%	3.5%	2.4%	3.0%	2.4%	3.0%	2.4%
Percent Hispanic/Latino	18.8%	3.8%	5.8%	5.4%	5.6%	4.5%	5.7%	4.5%	5.7%
Total Population		21,536	246,122	8,407	259,251	7,086	260,572	7,086	260,572
Count of IRW		10	88	3	95	2	96	2	96
Child, Subsistence Fisher									
Percent Low-Income	13.7%	6.9%	5.6%	7.0%	5.6%	7.0%	5.6%	6.5%	5.7%
Percent African American (non-Hispanic)	12.2%	10.1%	7.3%	11.4%	7.3%	11.4%	7.3%	12.2%	7.2%
Percent American Indian/Alaska Native	0.7%	5.2%	0.8%	7.0%	0.8%	7.0%	0.8%	0.2%	1.4%
Percent Asian	5.4%	1.3%	2.1%	1.4%	2.1%	1.4%	2.1%	1.5%	2.1%

Table 32d. Immediate Receiving Water Community Demographics by Joint Toxic Action Hazard Index Exceedances[a] for Neurological Impacts Under Baseline and the Regulatory Options for Arsenic-Cadmium-Lead Mixtures, Organized by Age and Fishing Mode Cohort[b]

Demographics	National Average	Baseline		Option 1		Option 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Percent Native Hawaiian/Pacific Islander	0.2%	0.1%	0.1%	0.2%	0.1%	0.2%	0.1%	0.2%	0.1%
Percent Other (non-Hispanic)	2.7%	2.5%	2.4%	3.3%	2.3%	3.3%	2.3%	3.5%	2.3%
Percent Hispanic/Latino	18.8%	6.2%	5.5%	3.7%	5.8%	3.7%	5.8%	3.8%	5.8%
Total Population		32,392	235,266	23,650	244,008	23,650	244,008	22,003	245,655
Count of IRW		15	83	12	86	12	86	11	87

Source: 2023 EA

Abbreviations: IRW (immediate receiving water).

a – EPA assessed human health impacts from the joint toxic action of multiple pollutants in steam electric power plant discharges, calculating a hazard index (HI) based on individual pollutant hazard quotients to determine exceedances of HI > 1.0. See the 2023 EA for more details on the analysis.

b – Lead blood levels only available for child cohorts. No exceedances under baseline or the regulatory options for adult (recreational) or adult (subsistence) fishers.

Table 32e. Immediate Receiving Water Community Demographics by Joint Toxic Action Hazard Index Exceedances[a] for Neurological Impacts Under Baseline and the Regulatory Options for Methylmercury-Lead Mixtures, Organized by Age and Fishing Mode Cohort[b]

Demographics	National Average	Baseline		Options 1 and 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Child, Recreational Fisher							
Percent Low-Income	**13.7%**	7.4%	5.4%	6.9%	5.5%	6.5%	5.6%
Percent African American (non-Hispanic)	**12.2%**	9.1%	7.4%	9.9%	7.3%	10.6%	7.3%
Percent American Indian/Alaska Native	**0.7%**	4.0%	0.8%	5.1%	0.8%	0.2%	1.5%
Percent Asian	**5.4%**	1.1%	2.2%	1.3%	2.1%	1.3%	2.1%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Percent Other (non-Hispanic)	**2.7%**	2.1%	2.5%	2.5%	2.4%	2.6%	2.4%
Percent Hispanic/Latino	**18.8%**	4.9%	5.8%	6.1%	5.6%	6.4%	5.5%
Total Population		42,822	224,836	32,957	234,701	30,745	236,913
Count of IRW		23	75	16	82	14	84
Child, Subsistence Fisher							
Percent Low-Income	**13.7%**	6.9%	5.4%	7.0%	5.5%	6.5%	5.6%
Percent African American (non-Hispanic)	**12.2%**	9.6%	7.2%	9.7%	7.3%	10.3%	7.3%
Percent American Indian/Alaska Native	**0.7%**	3.3%	0.8%	4.8%	0.8%	0.2%	1.5%
Percent Asian	**5.4%**	0.9%	2.3%	1.3%	2.1%	1.4%	2.1%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%

Table 32e. Immediate Receiving Water Community Demographics by Joint Toxic Action Hazard Index Exceedances[a] for Neurological Impacts Under Baseline and the Regulatory Options for Methylmercury-Lead Mixtures, Organized by Age and Fishing Mode Cohort[b]

Demographics	National Average	Baseline		Options 1 and 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Percent Other (non-Hispanic)	**2.7%**	1.8%	2.6%	2.4%	2.4%	2.5%	2.4%
Percent Hispanic/Latino	**18.8%**	5.8%	5.6%	5.8%	5.6%	6.1%	5.6%
Total Population		56,069	211,589	35,026	232,632	32,814	234,844
Count of IRW		28	70	19	79	17	81

Source: 2023 EA

Abbreviations: IRW (immediate receiving water).

a – EPA assessed human health impacts from the joint toxic action of multiple pollutants in steam electric power plant discharges, calculating a hazard index (HI) based on individual pollutant hazard quotients to determine exceedances of HI > 1.0. See the 2023 EA for more details on the analysis.

b – Lead blood levels only available for child cohorts. Joint toxic action analysis limited to child (recreational) and child (subsistence) cohorts.

Table 32f. Immediate Receiving Water Community Demographics by Joint Toxic Action Hazard Index Exceedances[a] for Renal Impacts Under Baseline and the Regulatory Options for Arsenic-Cadmium-Lead Mixtures, Organized by Age and Fishing Mode Cohort[b]

Demographics	National Average	Baseline		Options 1 and 2		Options 3 and 4	
		IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances	IRW with Exceedances	IRW without Exceedances
Child, Subsistence Fisher							
Percent Low-Income	**13.7%**	6.8%	5.7%	7.0%	5.6%	6.1%	5.7%
Percent African American (non-Hispanic)	**12.2%**	2.7%	8.0%	2.9%	7.9%	3.2%	7.9%
Percent American Indian/Alaska Native	**0.7%**	10.4%	0.7%	11.6%	0.7%	0.2%	1.4%
Percent Asian	**5.4%**	1.7%	2.0%	1.9%	2.0%	2.2%	2.0%
Percent Native Hawaiian/Pacific Islander	**0.2%**	0%	0.1%	0%	0.1%	0%	0.1%
Percent Other (non-Hispanic)	**2.7%**	2.9%	2.4%	3.2%	2.4%	3.5%	2.4%
Percent Hispanic/Latino	**18.8%**	3.5%	5.8%	3.1%	5.8%	3.1%	5.7%
Total Population		15,765	251,893	14,090	253,568	12,443	255,215
Count of IRW		11	87	9	89	8	90

Source: 2023 EA

Abbreviations: IRW (immediate receiving water).

a – EPA assessed human health impacts from the joint toxic action of multiple pollutants in steam electric power plant discharges, calculating a hazard index (HI) based on individual pollutant hazard quotients to determine exceedances of HI > 1.0. See the 2023 EA for more details on the analysis.

b – Lead blood levels only available for child cohorts. No exceedances under baseline or the regulatory options for child (recreational), adult (recreational), or adult (subsistence) fishers.

Cardiovascular and Hematological (Zn-Pb Mixture) Human Health Impacts

Among child subsistence fish consumers, under the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average in communities with immediate receiving waters with and without mixture-specific HI exceedances for cardiovascular and hematological human health impacts (Table 32a and Table 32c). The one exception to this occurs in communities wih immediate receiving waters without exceedances, where the percent of the population identified as American Indian or Alaska Native (non-Hispanic) is above the national average (Table 32a and Table32c). Comparing the percent of the population identified as low-income or a racial or ethnic minority population group between communities with immediate receiving waters with and without exceedances for cardiovascular and hematological human health impacts, the results of the baseline analysis shows that communities with immediate receiving waters with exceedances have smaller proportion of population groups of concern than the communities with immediate receiving waters without exceedances (Table 32a and Table 32c).

The results of the analysis of the regulatory options show that, compared to the baseline, all options results in no immediate receiving waters with mixture-specific HI exceedances for cardiovascular and hematological human health impacts (Table 32a and 32c).

Hematological (As-Cd-Pb Mixture) Human Health Impacts

Among child recreational fish consumers, under the baseline, the percent of the population identified as low-income or a racial and ethnic minority population group is less than the national average (Table 32b). The one exception to this occurs in communities with immediate receiving waters without mixture-specific HI exceedances for hematological human health impacts, where the percent of the population identified as American Indian or Alaska Native (non-Hispanic) is above the national average (Table 32b). When comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the results of the baseline analysis show that communities with immediate receiving waters with exceedances have a smaller proportion of population groups of concern than communities with immediate receiving waters without exceedances (Table 32b).

The results of the analysis of regulatory options show that none of the regulatory options result in a change in the number and distribution of immediate receiving waters with exceedances under the baseline (Table 32b).

Among child recreational fish consumers, under the baseline, the percent of the population identified as low-income or a racial and ethnic minority population is less than the national average in communities with immediate receiving waters with and without mixture-specific HI exceedances for hematological human health impacts, except for African-American (non-Hispanic) and Other (non-Hispanic) populations where exceedances are observed and American Indian or Alaska Native (non-Hispanic) populations where no exceedances are observed (Table 32b). When comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the percent of the population identified as low-income, African-American (non-Hispanic), and Other (non-Hispanic) is higher in communities with immediate receiving waters with exceedances (Table 32b). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of individuals in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 32b). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 32b).

The analysis of regulatory options showed that, compared to the baseline, all of the regulatory options reduced the amount of immediate receiving waters with mixture-specific HI exceedances for hematological health impacts and reduced the population affected by these exceedances. Options 3 and 4 would generate the largest improvements (Table 32b).

Compared to the baseline, Option 1 improves potential distributional disparities by reducing the proportion of the population identified as Other (non-Hispanic) to below the national average in communities with immediate receiving waters with exceedances (Table 32b). Additionally, when compared to the baseline, Option 1 reduces the proportion of the population identifying as low-income and African-American (non-Hispanic) in communities with immediate receiving waters with exceedances so that they are less than the proportion of the population in communities with immediate receiving waters without exceedances (Table 32b).

Relative to the baseline, across all population groups of concern, Options 2, 3, and 4 improve potential distributional disparities by reducing the proportion of the population identified as a population group of concern to below the national average in communities with immediate receiving waters with exceedances (Table 32b). Additionally, across all population groups of concern, Options 2, 3, and 4 reduce the proportion of the population identified as a population group of concern in communities with immediate receiving waters with exceedances so that they are less than in communities with immediate receiving waters without exceedances (Table 32b).

Neurological (As-Cd-Pb Mixture) Human Health Impacts

Among child recreational fish consumers, under the baseline, the percent of the population identified as low-income or a racial and ethnic minority population is less than the national average in communities with immediate receiving waters with and without mixture-specific HI exceedances for neurological human health impacts, except for African-American (non-Hispanic) and Other (non-Hispanic) populations where exceedances are observed and American Indian or Alaska Native (non-Hispanic) populations where no exceedances are observed (Table 32d). When comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the percent of the population identified as low-income, African-American (non-Hispanic), and Other (non-Hispanic) is higher in communities with immediate receiving waters with exceedances (Table 32d). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of individuals in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 32d). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 32d).

The analysis of regulatory options showed that, compared to the baseline, all of the regulatory options reduced the number of immediate receiving waters with mixture-specific HI exceedances for neurological human health impacts and reduced the population affected by these exceedances (Table 32d). Although, all of the regulatory options do not improve the distribution of population groups of concern in communities with immediate receiving waters with exceedances (Table 32d).

Compared to the baseline, Options 1 through 4 do not improve potential distributional disparities as the percent of the population identified as African-American (non-Hispanic) and Other (non-Hispanic) remain above the national average in communities with immediate receiving waters with exceedances (Table 32d). Additionally, relative to the baseline, under the regulatory options, the percent of the population identified as Native Hawaiian or Pacific Islander (non-Hispanic) increases to above the national average (Table 32d). Comparing the distribution of population groups of concern between communities with immediate receiving waters with and without exceedances, Options 1 through 4 maintain the baseline distribution, with the percent of the population identifying as low-income, African-American (non-Hispanic), Other (non-Hispanic) being larger in communities with immediate receiving waters with exceedances (Table 32d). In particular, the percent of the population identifying as African-American (non-Hispanic) in communities with immediate receiving waters with exceedances almost doubles compared to the baseline under Options 1 through 4 (Table 32d). Given that all the regulatory options result in a reduction in the number of immediate receiving waters with exceedances and the population affected by these exceedances, the increase in the proportion of the African-American (non-Hispanic) individuals relative to the baseline is likely due to the remaining communities with immediate receiving waters with exceedances have small populations with high concentrations of African-American (non-Hispanic) individuals (Table 32d).

Among child subsistence fish consumers, under the baseline, the percent of the population identified as low-income or a racial and ethnic minority population is less than the national average in communities with immediate receiving waters with and without mixture-specific HI exceedances for neurological human health impacts, except for American Indian or Alaska Native (non-Hispanic) populations where exceedances and no exceedances are observed (Table 32d). When comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the percent of the population identified as low-income, African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), Other (non-Hispanic), and Hispanic or Latino is greater in communities with immediate receiving waters with exceedances (Table 32d). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of individuals in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 32d). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 32d).

The analysis of regulatory options showed that, compared to the baseline, all of the regulatory options reduced the number of immediate receiving waters with mixture-specific HI exceedances for neurological human health impacts and reduced the population affected by these exceedances (Table 32d). Options 3 and 4 would generate the greatest improvements (Table 32d).

Compared to the baseline, Options 1 and 2 do not improve potential distributional disparities as the percent of the population identified as American Indian or Alaska Native (non-Hispanic) remains above the national average in communities with immediate receiving waters with exceedances (Table 32d). Additionally, relative to the baseline, under Options 1 and 2, the percent of the population identified as Other (non-Hispanic) increases to above the national average (Table 32d). Comparing the distribution of population groups of concern between communities with immediate receiving waters with and without exceedances, Options 1 and 2 improve the baseline distribution, as the percent of the population identifying as Hispanic or Latino in communities with immediate receiving waters with exceedances falls below the proportion in communities with immediate receiving waters without exceedances (Table 32d).

Relative to the baseline, Options 3 and 4 improve potential distributional disparities as the percent of the population identified as American Indian or Alaska Native (non-Hispanic) decreases to below the national average in communities with immediate receiving waters with exceedances (Table 32d). Although, the percent of the population identified as Other (non-Hispanic) increases to above the national averages in these communities (Table 32d). Comparing the distribution of population groups of concern between communities with immediate receiving waters with and without exceedances, Options 3 and 4 improve the baseline distribution, as the percent of the population identifying as American Indian or Alaska Native (non-Hispanic) and Hispanic or Latino in communities with immediate receiving waters with exceedances falls below the proportion in communities with immediate receiving waters without exceedances (Table 32d).

Neurological (MeHg-Pb Mixture) Human Health Impacts

Among child recreational fish consumers, under the baseline, the percent of the population identified as low-income or a racial and ethnic minority population is less than the national average in communities with immediate receiving waters with and without mixture-specific HI exceedances for neurological human health impacts, except for American Indian or Alaska Native (non-Hispanic) populations where exceedances and no exceedances are observed (Table 32e). When comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the percent of the population identified as low-income, African-American (non-Hispanic), and American Indian or Alaska Native (non-Hispanic) is greater in communities with immediate receiving waters with exceedances (Table 32e). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of individuals in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 32e). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 32e).

The analysis of regulatory options showed that, compared to the baseline, all of the regulatory options reduced the number of immediate receiving waters with mixture-specific HI exceedances for neurological human health impacts and reduced the population affected by these exceedances (Table 32e). Options 3 and 4 would generate the greatest improvements (Table 32e).

Options 1 and 2 maintain the baseline distribution of population groups of concern relative the national average (Table 32e). Comparing the distribution of population groups of concern between communities with immediate receiving waters with and without exceedances, Options 1 and 2 do not improve the baseline distribution, as the percent of the population identifying as low-income, African-American (non-Hispanic), and American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances remains greater than the proportion in communities with immediate receiving waters without exceedances (Table 32e). Additionally, compared to the baseline, the percent of the population identified as Other (non-Hispanic) and Hispanic or Latino increases in communities with immediate receiving waters with exceedances to be greater than the proportion in communities with immediate receiving waters without exceedances (Table 32e). Given that Options 1 and 2 result in a reduction in the number of immediate receiving waters with exceedances and the population affected by these exceedances, the increase in the proportion of the Other (non-Hispanic) and Hispanic or Latino individuals relative to the baseline is likely due to the remaining communities with immediate receiving waters with exceedances have small populations with high concentrations of these population groups (Table 32e).

Compared to the baseline, Options 3 and 4 improve the potential distributional disparities as the percent of the population identified as American Indian or Alaska Native (non-Hispanic) decreases to below the national average in communities with immediate receiving waters with exceedances (Table 32e). Comparing the distribution of population groups of concern between communities with immediate receiving waters with and without exceedances, Options 3 and 4 improve the baseline distribution as the percent of the population identifying as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances falls below the proportion in communities with immediate receiving waters without exceedances (Table 32e). Although, under Options 3 and 4, the percent of the population identified as Other (non-Hispanic) and Hispanic or Latino increases in communities with immediate receiving waters with exceedances to be greater than the proportion in communities with immediate receiving waters without exceedances (Table 32e). Given that Options 3 and 4 result in a reduction in the number of immediate receiving waters with exceedances and the population affected by these exceedances, the increase in the proportion of the Other (no-Hispanic) and Hispanic or Latino individuals relative to the baseline is likely due to the remaining communities with immediate receiving waters with exceedances have small populations with high concentrations of these population groups (Table 32e).

Among child subsistence fish consumers, under the baseline, the percent of the population identified as low-income or a racial and ethnic minority population is less than the national average in communities with immediate receiving waters with and without mixture-specific HI exceedances for neurological human health impacts, except for American Indian or Alaska Native (non-Hispanic) populations where exceedances and no exceedances are observed (Table 32e). When comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the percent of the population identified as low-income, African-American (non-Hispanic), American Indian or Alaska Native (non-Hispanic), and Hispanic or Latino is greater in communities with immediate receiving waters with exceedances (Table 32e). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of individuals in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 32e). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 32e).

The analysis of regulatory options showed that, compared to the baseline, all of the regulatory options reduced the number of immediate receiving waters with mixture-specific HI exceedances for neurological human health impacts and reduced the population affected by these exceedances (Table 32e). Options 3 and 4 would generate the greatest improvements (Table 32e).

Options 1 and 2 maintain the baseline distribution of population groups of concern relative the national average (Table 32e). Comparing the distribution of population groups of concern between communities with immediate receiving waters with and without exceedances, Options 1 and 2 also maintain the baseline distribution (Table 32e).

Compared to the baseline, Options 3 and 4 improve the potential distributional disparities as the percent of the population identified as American Indian or Alaska Native (non-Hispanic) decreases to below the national average in communities with immediate receiving waters with exceedances (Table 32e). Comparing the distribution of population groups of concern between communities with immediate receiving waters with and without exceedances, Options 3 and 4 improve the baseline distribution as the percent of the population identifying as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances falls below the proportion in communities with immediate receiving waters without exceedances (Table 32e). Although, under Options 3 and 4, the percent of the population identified as Other (non-Hispanic) increases in communities with immediate receiving waters with exceedances to be greater than the proportion in communities with immediate receiving waters without exceedances (Table 32e). Given that Options 3 and 4 result in a reduction in the number of immediate receiving waters with exceedances and the population affected by these exceedances, the increase in the proportion of the Other (no-Hispanic) individuals relative to the baseline is likely due to the remaining communities with immediate receiving waters with exceedances have small populations with high concentrations of these population groups (Table 32e).

Renal (As-Cd-Pb Mixture) Human Health Impacts

Among child subsistence fish consumers, under the baseline, the percent of the population identified as low-income or a racial and ethnic minority population is less than the national average in communities with immediate receiving waters with and without mixture-specific HI exceedances for renal human health impacts, except for American Indian or Alaska Native (non-Hispanic) and Other (non-Hispanic) populations where exceedances are observed (Table 32f). When comparing the percent of the population identified as low-income or a racial and ethnic minority population group between communities with immediate receiving waters with and without exceedances, the percent of the population identified as low-income, American Indian or Alaska Native (non-Hispanic), and Other (non-Hispanic) is greater in communities with immediate receiving waters with exceedances (Table 32f). Although, when comparing the populations identified as low-income or a racial ethnic minority population group in absolute terms, the number of individuals in these groups is higher in communities with immediate receiving waters without exceedances across all the population groups of concern (Table 32f). This is due to the fact that, under the baseline, the majority of immediate receiving waters do not have exceedances and the majority of the affected population lives in those areas (Table 32f).

The analysis of regulatory options showed that, compared to the baseline, all of the regulatory options reduced the number of immediate receiving waters with mixture-specific HI exceedances for neurological human health impacts and reduced the population affected by these exceedances (Table 32f). Options 3 and 4 would generate the greatest improvements (Table 32f).

Options 1 and 2 maintain the baseline distribution of population groups of concern relative the national average (Table 32f). Comparing the distribution of population groups of concern between communities with immediate receiving waters with and without exceedances, Options 1 and 2 also maintain the baseline distribution (Table 32f).

Compared to the baseline, Options 3 and 4 improve the potential distributional disparities as the percent of the population identified as American Indian or Alaska Native (non-Hispanic) decreases to below the national average in communities with immediate receiving waters with exceedances (Table 32f). Comparing the distribution of population groups of concern between communities with immediate receiving waters with and without exceedances, Options 3 and 4 improve the baseline distribution as the percent of the population identifying as American Indian or Alaska Native (non-Hispanic) in communities with immediate receiving waters with exceedances falls below the proportion in communities with immediate receiving waters without exceedances (Table 32f). Although, under Options 3 and 4, the percent of the population identified as Asian (non-Hispanic) increases in communities with immediate receiving waters with exceedances to be greater than the proportion in communities with immediate receiving waters without exceedances (Table 32f). Given that Options 3 and 4 result in a reduction in the number of immediate receiving waters with exceedances and the population affected by these exceedances, the increase in the proportion of the Asian (non-Hispanic) individuals relative to the baseline is likely due to the remaining communities with immediate receiving waters with exceedances have small populations with high concentrations of these population groups (Table 32f).

9.4.2 Key Conclusions

Based on the results of the distributional analysis of cumulative risks associated with exposures to multiple pollutants discharged from steam electric power plants, EPA found that, across mixtures of concern and fish consumers, under the baseline PEJC were observed largely among affected American Indian or Alaska Native (non-Hispanic) populations when comparing the percent of the population affected in communities with immediate receiving waters with mixture-specific HI exceedances for relevant human health endpoints to the national average. Making an internal comparison between the affected population, EPA found PEJC among specific population groups of concern as they comprised a larger proportion of the population in communities with immediate receiving waters with exceedances than in communities with immediate receiving waters without non-cancer and cancer exceedances. Analyzing the regulatory options, EPA found that, across mixtures of concern and fish consumers, Options 3 and 4 most often generated the largest reductions in immediate receiving waters with non-cancer and cancer exceedances and the population affected by these exceedances. EPA also found that, across mixtures of concern and fish consumers, Options 3 and 4 most often produced the greatest improvements in the distribution of impacts across the population groups of concern relative to the baseline. Given this, EPA concluded that the regulatory options, particularly Options 3 and 4, reduce exceedances in immediate receiving waters and the population affected by these exceedances, as well as mitigate some of the PEJC observed under the baseline in terms of the distribution of population groups of concern in communities with immediate receiving waters with exceedances relative to the average community in the United States and to communities with immediate receiving waters without exceedances.

10. Distributional Analysis of Benefits and Costs of the Proposed Rule

EPA examined the benefits and costs of the regulatory options in this proposal for potential disparities, in addition to evaluating the distribution of exposures and health impacts discussed above. Office of Management and Budget (OMB) Circular A-4 (2003), which implements E.O. 12866 (58 FR 51735 September 30, 1993), states that regulatory analyses "should provide a separate description of distributional effects (*i.e.*, how both benefits and costs are distributed among sub-populations of particular concern)" As discussed below, EPA research demonstrates that climate change impacts disparately accrue to minority and low-income populations, but evaluation of other benefits and costs under the proposed rule may not have substantial impacts.

10.1 Benefits

EPA began its evaluation of benefits with a screening of the benefit categories. For Option 3 at both three percent and seven percent discount rates, approximately 99 percent of benefits accrued from reductions in air pollution due to estimated shifts in electric generation resulting from the incremental costs of the proposed rule. Furthermore, these air benefits were always comprised of approximately a 3-to-1 ratio of conventional air pollutants health benefits to greenhouse gas (GHG) benefits. Thus, while EPA evaluated a number of exposures and endpoints for disproportionate impacts, as discussed above, for purposes of evaluating benefits, the Agency screened these two benefit categories through this initial comparison for further evaluation.[47]

10.1.1 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, she 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 minority populations 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 PEJC (USGCRP, 2018; USGCRP, 2016; Oppenheimer et al., 2014; Porter et al., 2014; Smith et al., 2014; IPCC, 2018; National Research Council, 2011; NASEM, 2017). These reports conclude that poorer or predominantly non-White communities 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 information resources. Some communities of color, specifically populations defined jointly by ethnic/racial characteristics and geographic location, may be uniquely vulnerable to climate change health impacts in the United States. In particular, the 2016 scientific assessment on the *Impacts of*

47. EPA acknowledges that while the screening of benefits under Option 3 showed that nearly all the benefits associated with the regulatory option 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.

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.

10.1.1.1 Effects on Specific Populations 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 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 proximities 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 (2021c) 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 populations 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 (2021c) 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 Islanders 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 communities 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, 2021c). Moreover, people of color are disproportionately exposed to air pollution based on where they live, and disproportionately vulnerable due to higher baseline prevalence of underlying diseases such as asthma, so climate exacerbations of air pollution are expected to have disproportionate effects on these communities.

Indeed, Native American Tribal 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. Tribal 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. The 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, 2021c). 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 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 disproportionately 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 minority and low-income populations

10.1.2 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; U.S. EPA, 2022f). In addition, demographic-stratified information relating $PM_{2.5}$ and ozone to other health effects and valuation estimates is currently lacking.

10.2 Costs

Energy provides many services to households that are necessary for a basic standard of living. The proposed 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 distribution and for different racial/ethnic groups. The goal of this section is to highlight which populations and communities 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 U.S.. Low-income and minority households 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 minority head-of-household, 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 2019 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 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 33. Energy Expenditures by Quintiles of Income before Taxes, 2019

	All	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Average income after taxes	$71,487	$12,236	$32,945	$53,123	$83,864	$174,777
Average annual expenditures	$63,036	$28,672	$40,472	$53,045	$71,173	$121,571
Natural gas	$416	$259	$355	$367	$455	$644
Electricity	$1,472	$1,049	$1,351	$1,446	$1,587	$1,924
Fuel oil and other fuels	$113	$69	$101	$86	$121	$189
Gasoline, other fuels, and motor oil (transportation)	$2,094	$998	$1,601	$2,079	$2,593	$3,193

Table 33. Energy Expenditures by Quintiles of Income before Taxes, 2019

	All	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Total expenditures on energy	$4,095	$2,375	$3,408	$3,978	$4,756	$5,950
Energy expenditures as share of total expenditures	6.5%	8.3%	8.4%	7.5%	6.7%	4.9%
Energy expenditures as share of income	5.7%	19.4%	10.3%	7.5%	5.7%	3.4%
Quintile's share of all energy expenditures		11.6%	16.7%	19.4%	23.2%	29.1%

Source: U.S. Bureau of Labor Statistics, 2020

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 33 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 11.6 percent of energy expenditures, while the highest quintile accounted for 29 percent. However, energy expenditures as a share of total household expenditures were 8.3 percent for the lowest income quintile and 4.9 percent for the highest income quintile. For energy expenditures as a share of average after-tax income, the distribution is more unequal, ranging from 19.4 percent for the lowest income quintile to 3.4 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 $6,000 per household on energy and had an average after-tax income of $175,000 in 2019 while the lowest income quintile spent about $2,400 per household on energy and had $12,000 of after-tax income. Thus, lower income households consume less energy than high 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.

See Table 34 for 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 34. Demographics by Quintiles of Income before Taxes, 2019

	All	Lowest 20%	Second 20%	Third 20%	Fourth 20%	Highest 20%
Number of consumer units (thousands)	132,242	26,367	26,387	26,578	26,375	26,536
Black	13%	20%	16%	13%	10%	8%
White, Asian, and all other races	87%	80%	84%	87%	90%	92%
Hispanic or Latino	14%	13%	17%	17%	12%	9%
Not Hispanic or Latino	86%	87%	83%	83%	88%	91%

Source: U.S. Bureau of Labor Statistics, 2020

Table 35 and Table 36 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 35. Energy Expenditures by Race, 2019

	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, 2020

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 36. Energy Expenditures by Race or Ethnicity, 2019

	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
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, 2020

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.

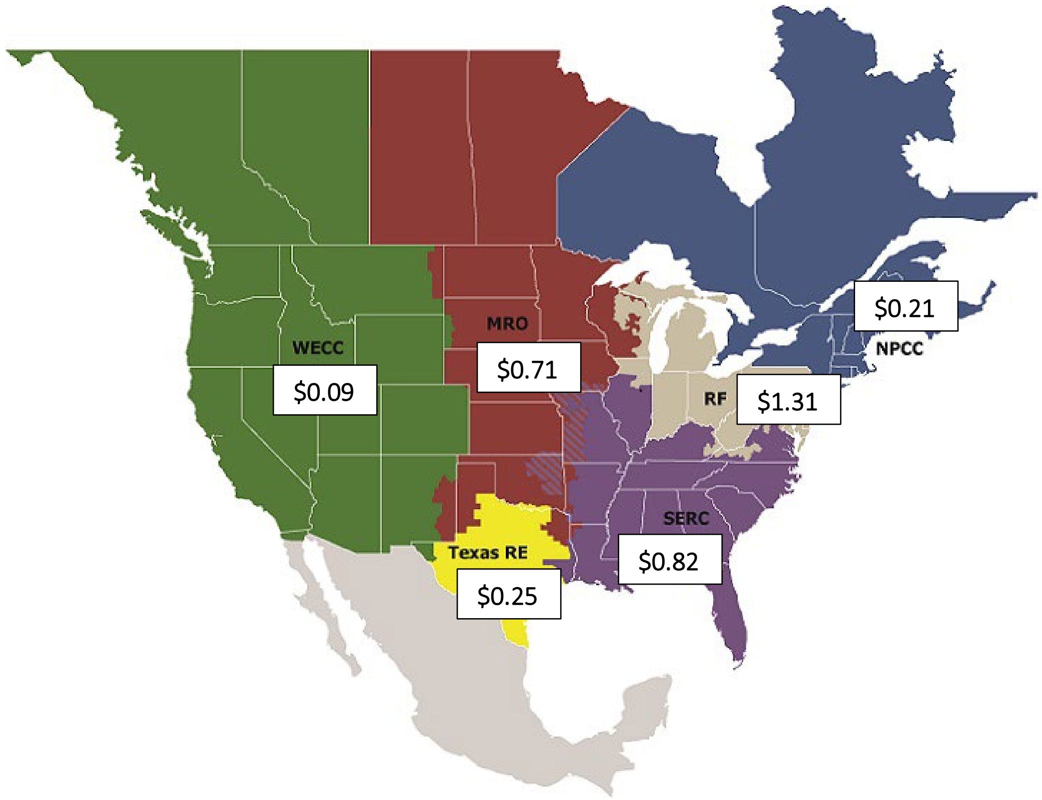
The CES data summarized in this section highlight the higher energy burdens experienced by low-income, Black, and Hispanic households under baseline conditions. The proposed rule may increase energy prices, which could exacerbate existing inequalities in energy burden.

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 2023 RIA, suggested very small potential changes in electricity costs as a result of the proposed rule. At the national level, average compliance costs per residential households for Option 3 are $0.63 per year. These costs vary across North American Electric Reliability Corporation (NERC)[48] regions (see Figure 8), however, with average compliance costs per residential households ranging from $0.09 per year in Western Electricity Coordinating Council (WECC) to $1.31 per year in Reliability First Corporation (RF). 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

48. 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.

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 proposed rule is expected to have a very small impact in the absolute across all regions analyzed which is also small relatively as the potential price increase is less than 0.1 percent of energy expenditures for all income and race groups, and even below 0.1 percent of just electricity expenditures for all but the bottom quintile income group in the most impacted NERC region. Furthermore, these small impacts may be further moderated by existing pricing structures.

Figure 8. Estimated Average Annual Compliance Costs of the Proposed Rule (Option 3) per Residential Household, by NERC Region



11. Limitations and Uncertainties

Tables 37-43 present a discussion of the limitations and uncertainties of EPA's distributional analysis and their potential effects on the analysis.

Table 37. Limitations and Uncertainties of EPA's Proximity and Community Screening Analyses

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	Different portions of the same CBG may fall within the buffer area 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 the zip codes, and accordingly, ZCTAs served by PWS, as reported in the SDWIS database, as representative of the population potentially affected by reductions in halogenated disinfection by-products due to steam electric power plant discharges.	Uncertain	ZCTAs and tribal areas can be served by multiple PWS and some PWS serve people across multiple ZCTAs, such that the affected population may have different socioeconomic characteristics. Additionally, ZCTAs are approximate area representations of USPS zip codes, so there is some error present in the populations included under respective zip codes. Additionally, the U.S. Census Bureau is not able to estimate ZCTAs for all USPS zip codes, therefore, for EPA's analysis some systems were not able to be analyzed as there were no ZCTAs boundaries estimated for the zip code(s) they served.
EPA used the SDWIS database and a zip code to ZCTA crosswalk to identify ZCTAs served by affected PWS. For any PWSIDs without any associated ZCTA information, EPA used the PWS Name and the PWS latitude and longitude to identify associated tribal areas.	Uncertain	There may be some PWS that serve ZCTAs and tribal areas. However, if only the ZCTA was listed in SDWIS, the EJ analysis does not account for the associated tribal area.
For systems EPA identified that were not found in the UCMR4 dataset, the zip code reported for the system in the SDWIS dataset was used as the zip code served for that system.	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 38. 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 and 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 estimating health effects stratified by population group and valuing those effects.

Table 39. 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: Do not include site-specific details or detailed modeling of pollutants within the receiving water. Are used to estimate pollutant concentrations in the fish tissue and to evaluate wildlife impacts. Are used to estimate human exposure impacts.	Uncertain	1. See Appendix C of the 2020 EA for details. An example of this can be found in Appendix D, 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. 3. Individual exposure factors, such as ingestion rate, body weight, and exposure duration, are variable due to physical 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

Table 39. Limitations and Uncertainties of EPA's Distributional Analysis of Immediate Receiving Water Impacts

Uncertainty/Limitation	Effect on Analysis	Notes
		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 40. 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 human health effects from reductions in lead exposure analysis is based on the Integrated Exposure Uptake Biokinetic (IEUBK) model geometric mean blood lead (PbB) 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), so some of the change between the baseline and regulatory options is not accounted for by using the model (*i.e.*, IEUBK does not capture very small changes) since the 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 PEJC. This could increase inequities in the baseline and affect the extent to which the regulatory options may increase or decrease 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 different distribution of baseline and regulatory option impacts.

Table 41. 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 evaluates 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 distribution of TTHM concentrations, bladder cancer cases, and excess bladder cancer deaths across drinking water systems under the baseline. Given this, EPA could not conclude whether the changes modeled under the regulatory options affected potential distributional disparities–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 under the baseline.

Table 42. 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 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 PEJC, 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	Underestimate	Lead is included in all three pollutant mixtures evaluated in the cumulative risk analysis. The

Table 42. Limitations and Uncertainties of EPA's Distributional Analysis of Cumulative Risks

Uncertainty/Limitation	Effect on Analysis	Notes
health endpoints for only child cohorts under the age of 11 years old.		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 endpoint-specific HQ values are not greater than or equal to 0.1.

Table 43. 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 to value benefits from air quality improvements across various racial/ethnic groups.

12. 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 and minority populations 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 and drinking water will accrue to minority and low-income populations at a higher rate under some or all of the proposed regulatory options, with Options 3 and 4 generating the greatest improvements. Remaining exposures, impacts, costs, and benefits analyzed either accrue at a higher rate to populations which are not minority 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 proposed regulatory options 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 and minority communities.

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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 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4
Antimony	Decreases	0.9%	32.8%	70.2%	75.1%	6.3%	15.6%	15.5%	15.7%
	No changes	99.1%	67.2%	29.8%	24.9%	16.1%	15.5%	15.6%	15.4%
Arsenic	Decreases	66.2%	74.9%	89.7%	91.5%	15.4%	16.1%	15.9%	16.0%
	No changes	33.8%	25.1%	10.3%	8.5%	15.9%	13.4%	13.6%	12.2%
Cadmium	Decreases	66.2%	74.9%	89.7%	91.5%	15.4%	16.1%	15.9%	16.0%
	No changes	33.8%	25.1%	10.3%	8.5%	15.9%	13.4%	13.6%	12.2%
Cyanide(a)	Decreases	0.0%	70.0%	70.0%	91.2%	0.0%	16.9%	16.9%	18.8%
	No changes	100.0%	30.0%	30.0%	8.8%	18.3%	23.0%	23.0%	7.9%
Lead(a)	Decreases	1.2%	41.5%	89.0%	95.1%	6.3%	15.5%	15.4%	15.6%
	No changes	98.8%	58.5%	11.0%	4.9%	16.8%	16.7%	19.6%	20.1%
Manganese	Decreases	0.9%	32.8%	70.2%	75.1%	6.3%	15.6%	15.5%	15.7%
	No changes	99.1%	67.2%	29.8%	24.9%	16.1%	15.5%	15.6%	15.4%
Mercury	Decreases	66.2%	74.9%	89.7%	91.5%	15.4%	16.1%	15.9%	16.0%
	No changes	33.8%	25.1%	10.3%	8.5%	15.9%	13.4%	13.6%	12.2%
Thallium	Decreases	0.9%	32.8%	70.2%	75.1%	6.3%	15.6%	15.5%	15.7%
	No changes	99.1%	67.2%	29.8%	24.9%	16.1%	15.5%	15.6%	15.4%
United States						**13.7%**			

Source: U.S. EPA Analysis, 2023

Notes

a) 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 American Indian/Alaska Native				Percent Asian			
		Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4
Antimony	Decreases	0.9%	32.8%	70.2%	75.1%	0.1%	0.3%	0.6%	0.6%	6.8%	3.6%	3.3%	3.2%	0.0%	0.0%	0.1%	0.1%
	No changes	99.1%	67.2%	29.8%	24.9%	0.5%	0.6%	0.3%	0.3%	3.5%	3.7%	4.2%	4.4%	0.1%	0.1%	0.1%	0.1%
Arsenic	Decreases	66.2%	74.9%	89.7%	91.5%	0.3%	0.3%	0.5%	0.5%	3.7%	3.8%	3.6%	3.6%	0.1%	0.1%	0.1%	0.1%
	No changes	33.8%	25.1%	10.3%	8.5%	1.0%	1.2%	0.2%	0.2%	3.6%	3.3%	3.9%	4.1%	0.1%	0.1%	0.0%	0.0%
Cadmium	Decreases	66.2%	74.9%	89.7%	91.5%	0.3%	0.3%	0.5%	0.5%	3.7%	3.8%	3.6%	3.6%	0.1%	0.1%	0.1%	0.1%
	No changes	33.8%	25.1%	10.3%	8.5%	1.0%	1.2%	0.2%	0.2%	3.6%	3.3%	3.9%	4.1%	0.1%	0.1%	0.0%	0.0%
Cyanide(a)	Decreases	0.0%	70.0%	70.0%	91.2%	0.0%	0.3%	0.3%	0.3%	0.0%	3.2%	3.2%	3.1%	0.0%	0.0%	0.0%	0.0%
	No changes	100.0%	30.0%	30.0%	8.8%	0.3%	0.3%	0.3%	0.4%	3.0%	2.4%	2.4%	2.5%	0.0%	0.1%	0.1%	0.1%
Lead(a)	Decreases	1.2%	41.5%	89.0%	95.1%	0.1%	0.3%	0.6%	0.6%	6.8%	3.8%	3.5%	3.4%	0.0%	0.0%	0.1%	0.1%
	No changes	98.8%	58.5%	11.0%	4.9%	0.6%	0.9%	0.2%	0.2%	3.5%	3.7%	5.9%	7.7%	0.1%	0.1%	0.1%	0.0%
Manganese	Decreases	0.9%	32.8%	70.2%	75.1%	0.1%	0.3%	0.6%	0.6%	6.8%	3.6%	3.3%	3.2%	0.0%	0.0%	0.1%	0.1%
	No changes	99.1%	67.2%	29.8%	24.9%	0.5%	0.6%	0.3%	0.3%	3.5%	3.7%	4.2%	4.4%	0.1%	0.1%	0.1%	0.1%
Mercury	Decreases	66.2%	74.9%	89.7%	91.5%	0.3%	0.3%	0.5%	0.5%	3.7%	3.8%	3.6%	3.6%	0.1%	0.1%	0.1%	0.1%
	No changes	33.8%	25.1%	10.3%	8.5%	1.0%	1.2%	0.2%	0.2%	3.6%	3.3%	3.9%	4.1%	0.1%	0.1%	0.0%	0.0%
Thallium	Decreases	0.9%	32.8%	70.2%	75.1%	0.1%	0.3%	0.6%	0.6%	6.8%	3.6%	3.3%	3.2%	0.0%	0.0%	0.1%	0.1%
	No changes	99.1%	67.2%	29.8%	24.9%	0.5%	0.6%	0.3%	0.3%	3.5%	3.7%	4.2%	4.4%	0.1%	0.1%	0.1%	0.1%
United States						**12.2%**				**0.7%**				**5.4%**			

Source: U.S. EPA Analysis, 2023

Notes:

a) 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 Native Hawaiian/Pacific Islander				Percent Other non-Hispanic				Percent Hispanic/Latino			
		Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4	Option 1	Option 2	Option 3	Option 4
Antimony	Decreases	0.9%	32.8%	70.2%	75.1%	2.7%	2.3%	2.4%	2.4%	10.2%	12.4%	10.3%	10.1%	9.3%	13.7%	13.7%	13.7%
	No changes	99.1%	67.2%	29.8%	24.9%	2.5%	2.6%	2.6%	2.6%	10.6%	9.5%	10.8%	11.2%	13.5%	13.1%	12.8%	12.7%
Arsenic	Decreases	66.2%	74.9%	89.7%	91.5%	2.5%	2.4%	2.5%	2.5%	9.6%	11.3%	11.1%	11.0%	13.1%	13.2%	13.4%	13.4%
	No changes	33.8%	25.1%	10.3%	8.5%	2.5%	2.7%	2.3%	2.4%	12.8%	7.4%	7.2%	7.4%	13.9%	13.7%	13.0%	12.7%
Cadmium	Decreases	66.2%	74.9%	89.7%	91.5%	2.5%	2.4%	2.5%	2.5%	9.6%	11.3%	11.1%	11.0%	13.1%	13.2%	13.4%	13.4%
	No changes	33.8%	25.1%	10.3%	8.5%	2.5%	2.7%	2.3%	2.4%	12.8%	7.4%	7.2%	7.4%	13.9%	13.7%	13.0%	12.7%
Cyanide (a)	Decreases	0.0%	70.0%	70.0%	91.2%	0.0%	2.2%	2.2%	2.2%	0.0%	13.1%	13.1%	12.0%	0.0%	14.5%	14.5%	14.6%
	No changes	100.0%	30.0%	30.0%	8.8%	2.2%	2.3%	2.3%	2.6%	11.8%	7.2%	7.2%	7.4%	14.5%	14.6%	14.6%	12.4%
Lead (a)	Decreases	1.2%	41.5%	89.0%	95.1%	2.7%	2.3%	2.4%	2.4%	10.2%	13.3%	11.0%	10.7%	9.3%	13.7%	13.7%	13.7%
	No changes	98.8%	58.5%	11.0%	4.9%	2.5%	2.7%	3.0%	3.4%	11.0%	8.0%	10.5%	12.8%	13.5%	12.6%	10.4%	8.5%
Manganese	Decreases	0.9%	32.8%	70.2%	75.1%	2.7%	2.3%	2.4%	2.4%	10.2%	12.4%	10.3%	10.1%	9.3%	13.7%	13.7%	13.7%
	No changes	99.1%	67.2%	29.8%	24.9%	2.5%	2.6%	2.6%	2.6%	10.6%	9.5%	10.8%	11.2%	13.5%	13.1%	12.8%	12.7%
Mercury	Decreases	66.2%	74.9%	89.7%	91.5%	2.5%	2.4%	2.5%	2.5%	9.6%	11.3%	11.1%	11.0%	13.1%	13.2%	13.4%	13.4%
	No changes	33.8%	25.1%	10.3%	8.5%	2.5%	2.7%	2.3%	2.4%	12.8%	7.4%	7.2%	7.4%	13.9%	13.7%	13.0%	12.7%
Thallium	Decreases	0.9%	32.8%	70.2%	75.1%	2.7%	2.3%	2.4%	2.4%	10.2%	12.4%	10.3%	10.1%	9.3%	13.7%	13.7%	13.7%
	No changes	99.1%	67.2%	29.8%	24.9%	2.5%	2.6%	2.6%	2.6%	10.6%	9.5%	10.8%	11.2%	13.5%	13.1%	12.8%	12.7%
United States						**0.2%**				**2.7%**				**18.8%**			

Source: U.S. EPA Analysis, 2023

Notes:

a) 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.

Appendix B: Results from the Screening Analyses

This section of the appendix presents the results of the screening analyses performed as part of EPA's analysis of socioeconomic and environmental characteristics of communities expected to be affected by the proposed rule. Correlation plots and box plots EPA generated through the EJSCREENBatch tool are presented for each exposure pathway at the state and national levels, at each of the relevant radii. While EPA developed an approach to identifying PEJC in communities using multiple indicator criteria thresholds, the Agency notes that, as shown in the boxplots, the EJSCREENBatch tool uses a single indicator criteria threshold, the 80th percentile, to assess PEJC in communities.

Section 1: Results from the Air Screening Analysis

Figure B-1. State Percentile Socioeconomic Indicators Correlation Plot Using A 1-mile Radius

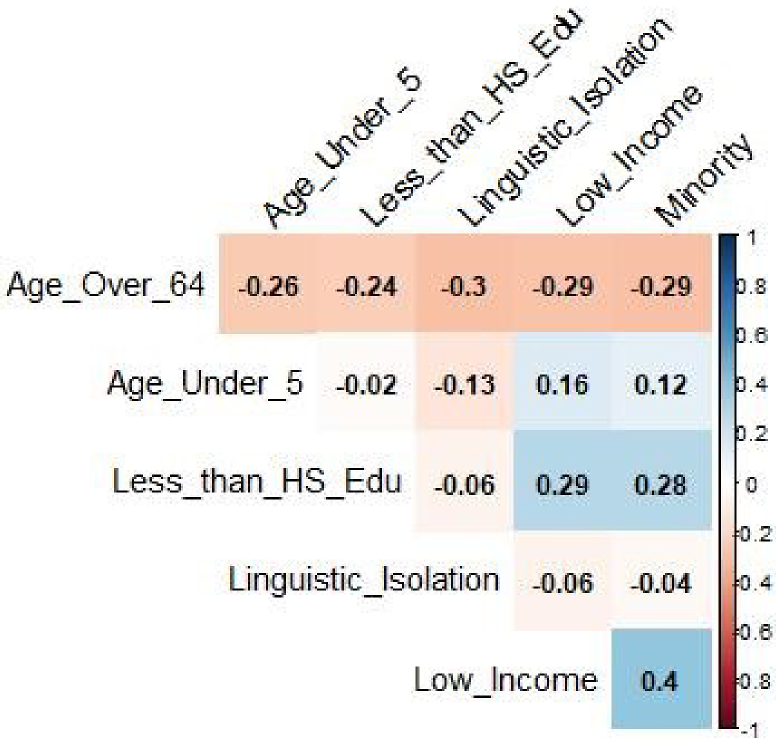


Figure B-2. State Percentile Environmental Indicators Correlation Plot Using A 1-mile Radius

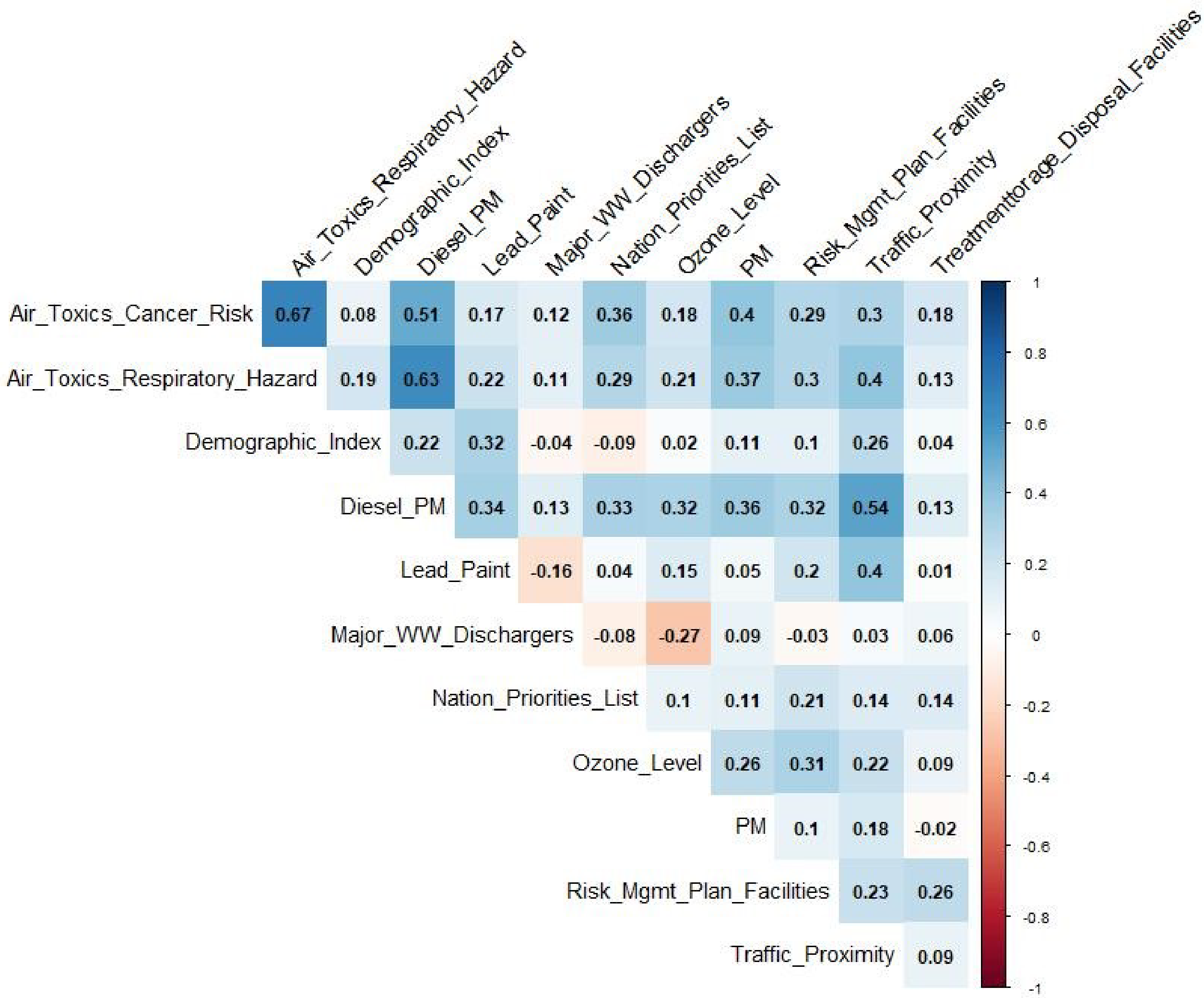


Figure B-3. State Percentile Socioeconomic Indicators Box Plot Using A 1-mile Radius

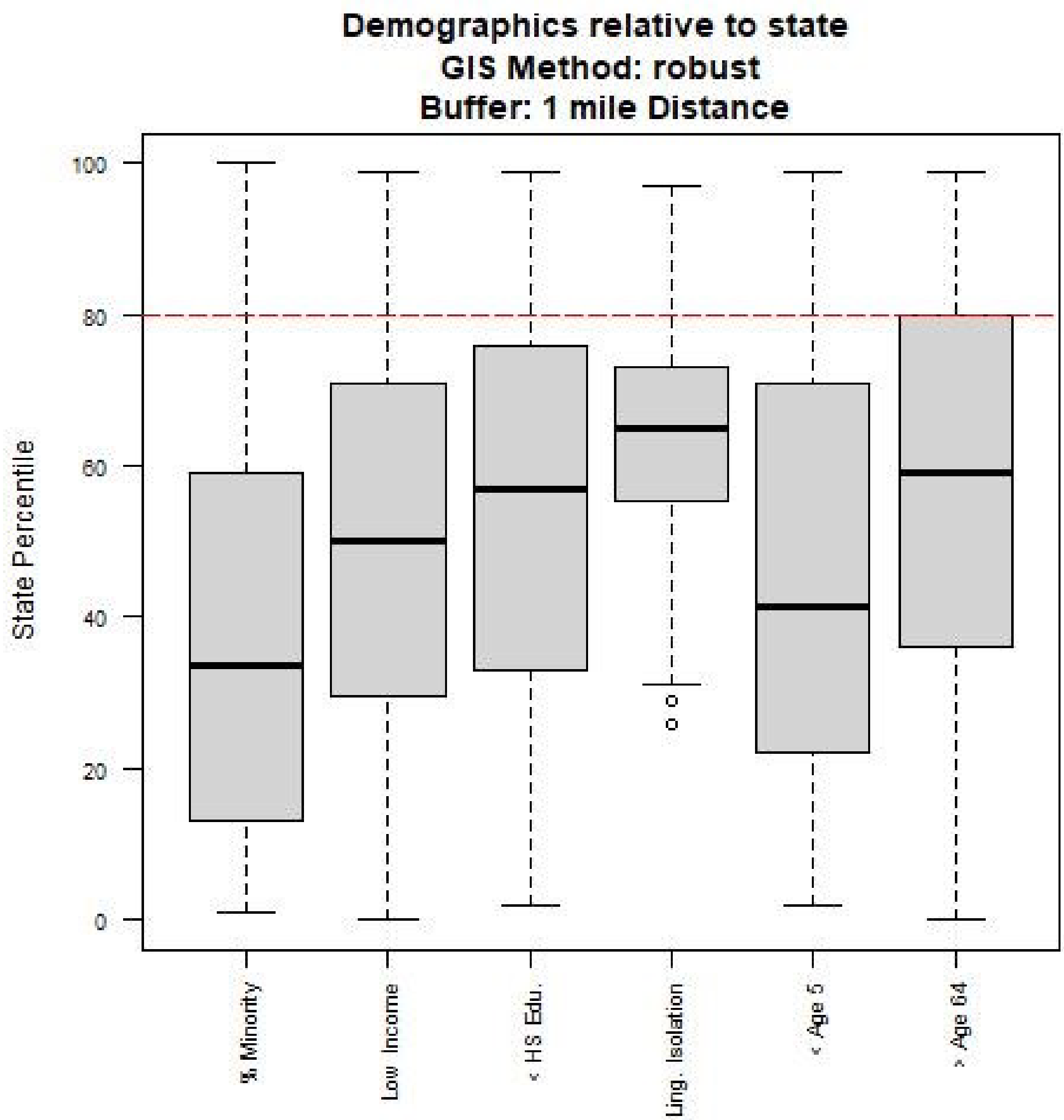


Figure B-4. State Percentile Environmental Indicators Box Plot Using A 1-mile Radius

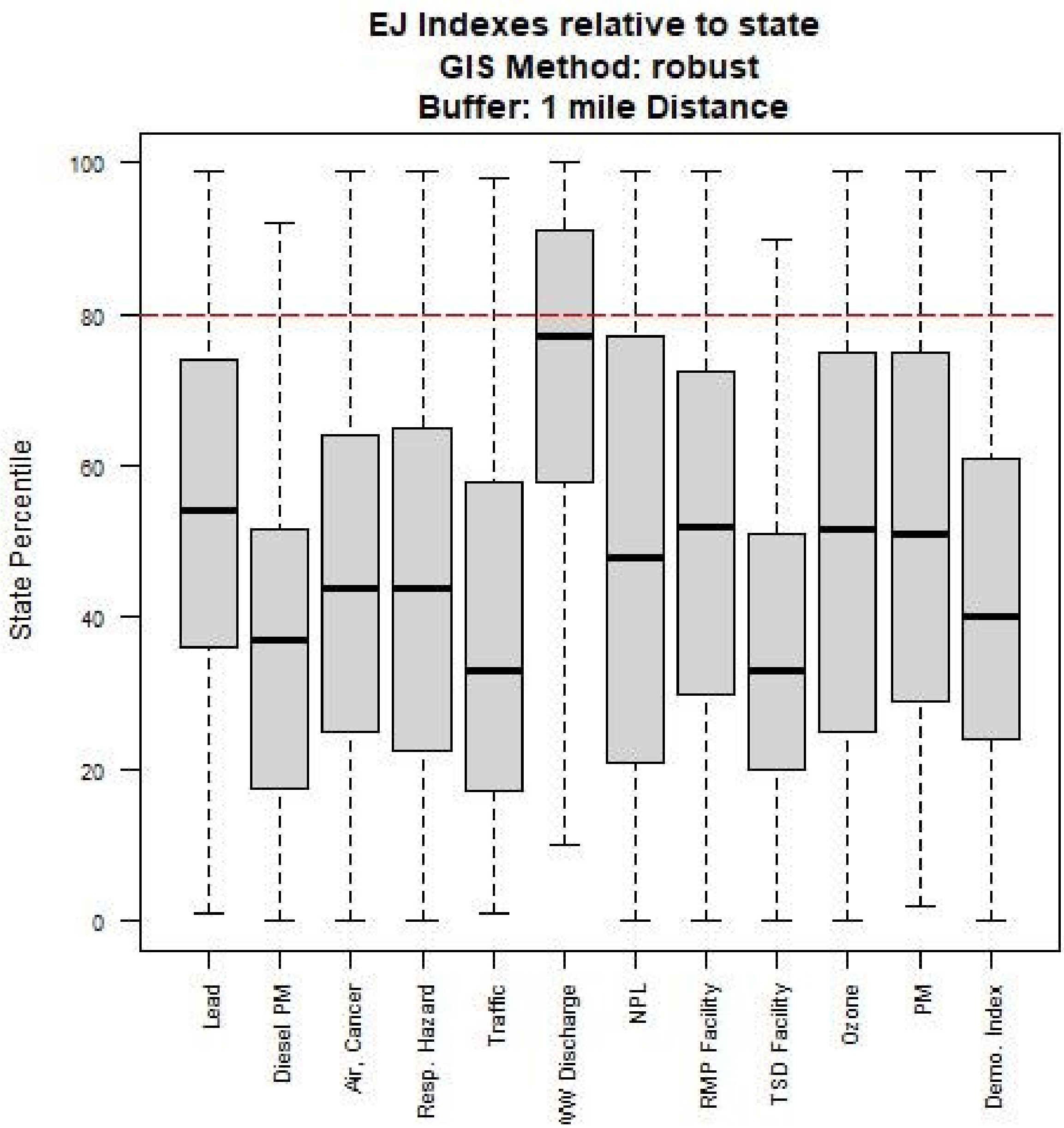


Figure B-5. National Percentile Socioeconomic Indicators Correlation Plot Using A 1-mile Radius

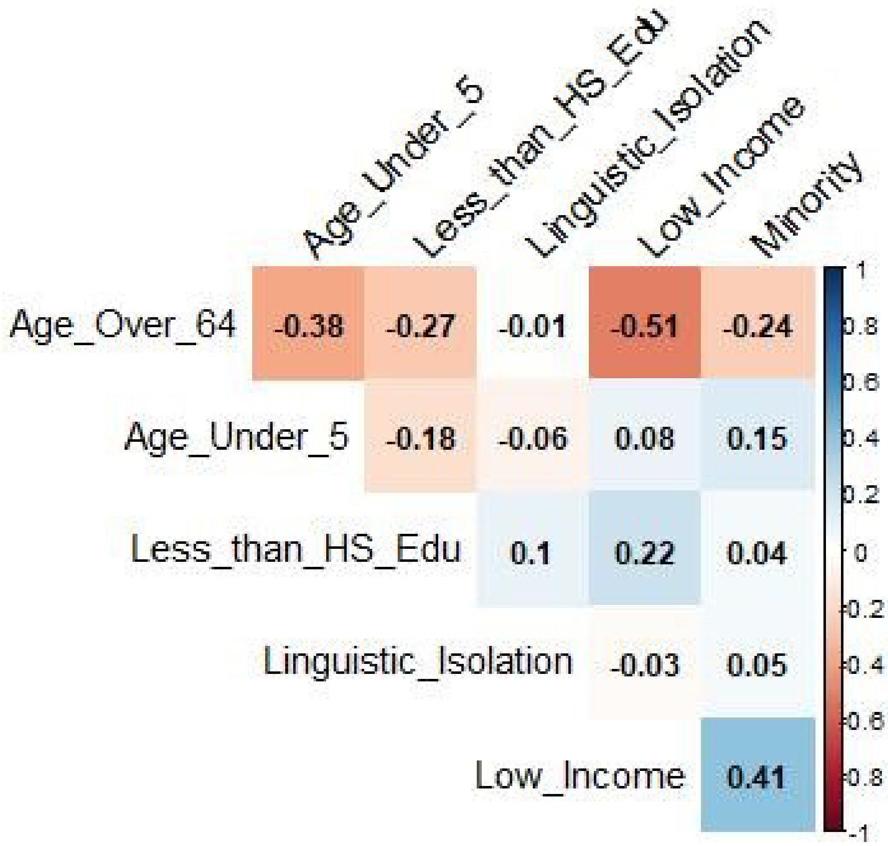


Figure B-6. National Percentile Environmental Indicators Correlation Plot Using A 1-mile Radius

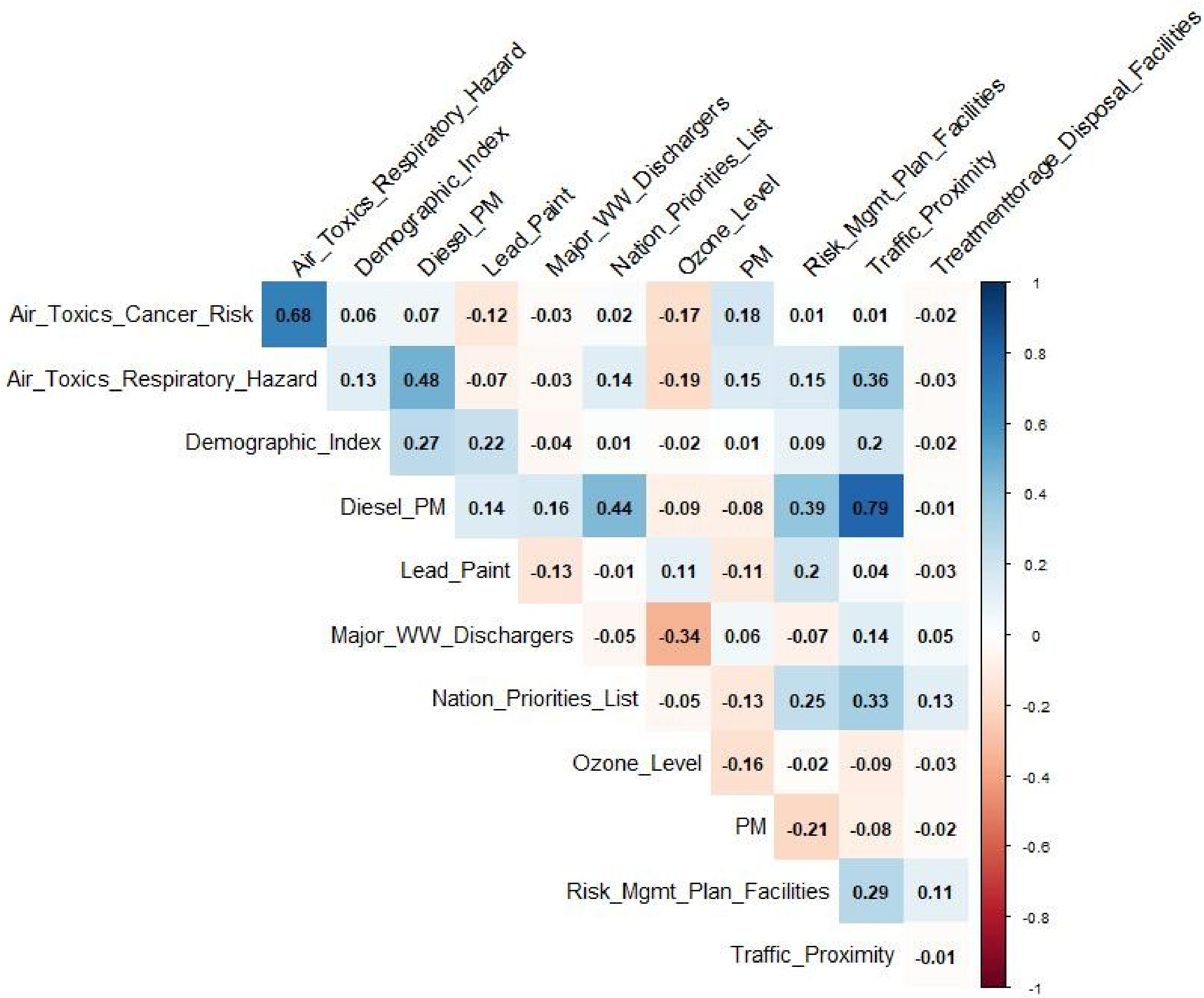


Figure B-7. National Percentile Socioeconomic Indicators Box Plot Using A 1-mile Radius

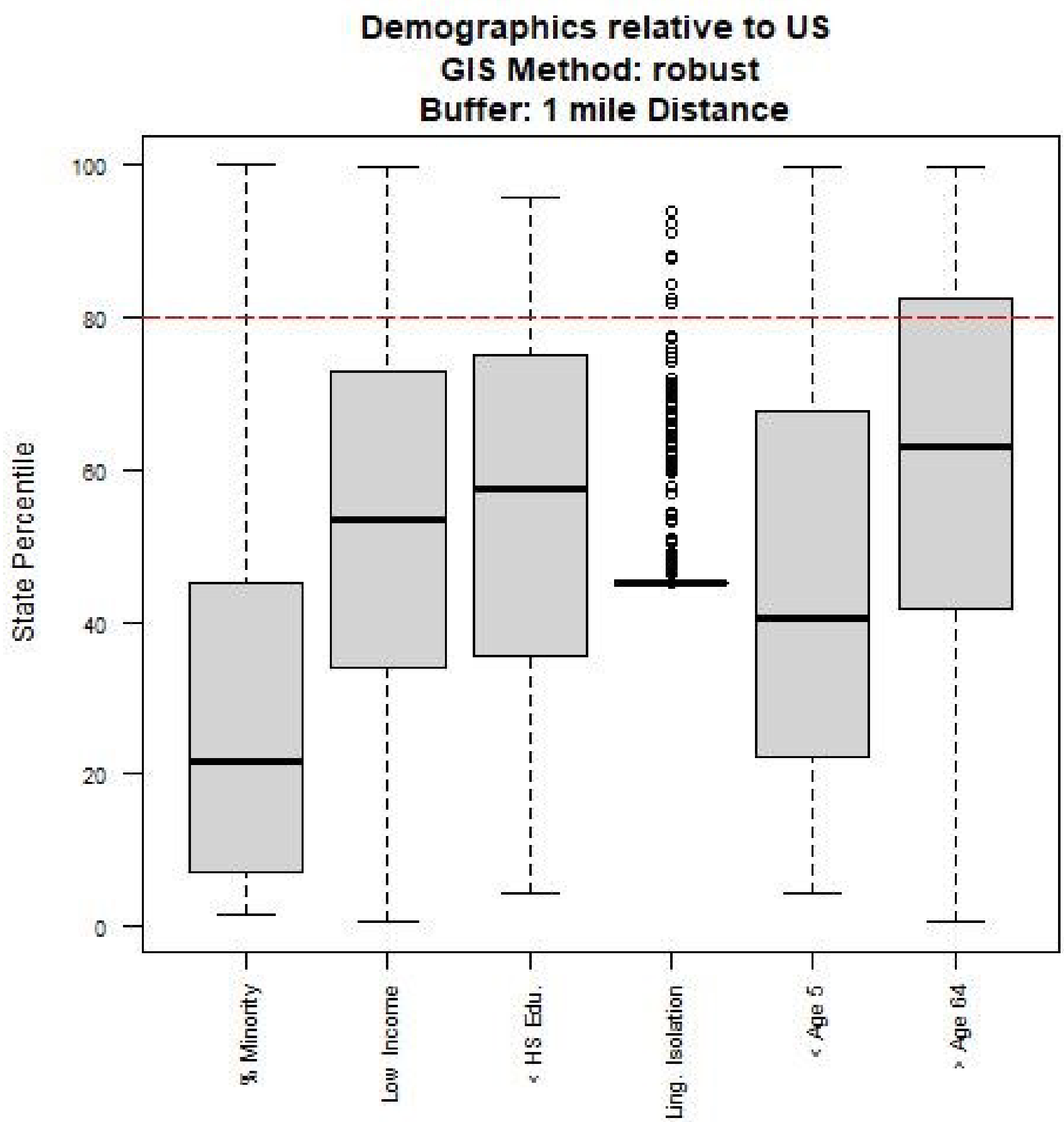


Figure B-7. National Percentile Environmental Indicators Box Plot Using A 1-mile Radius

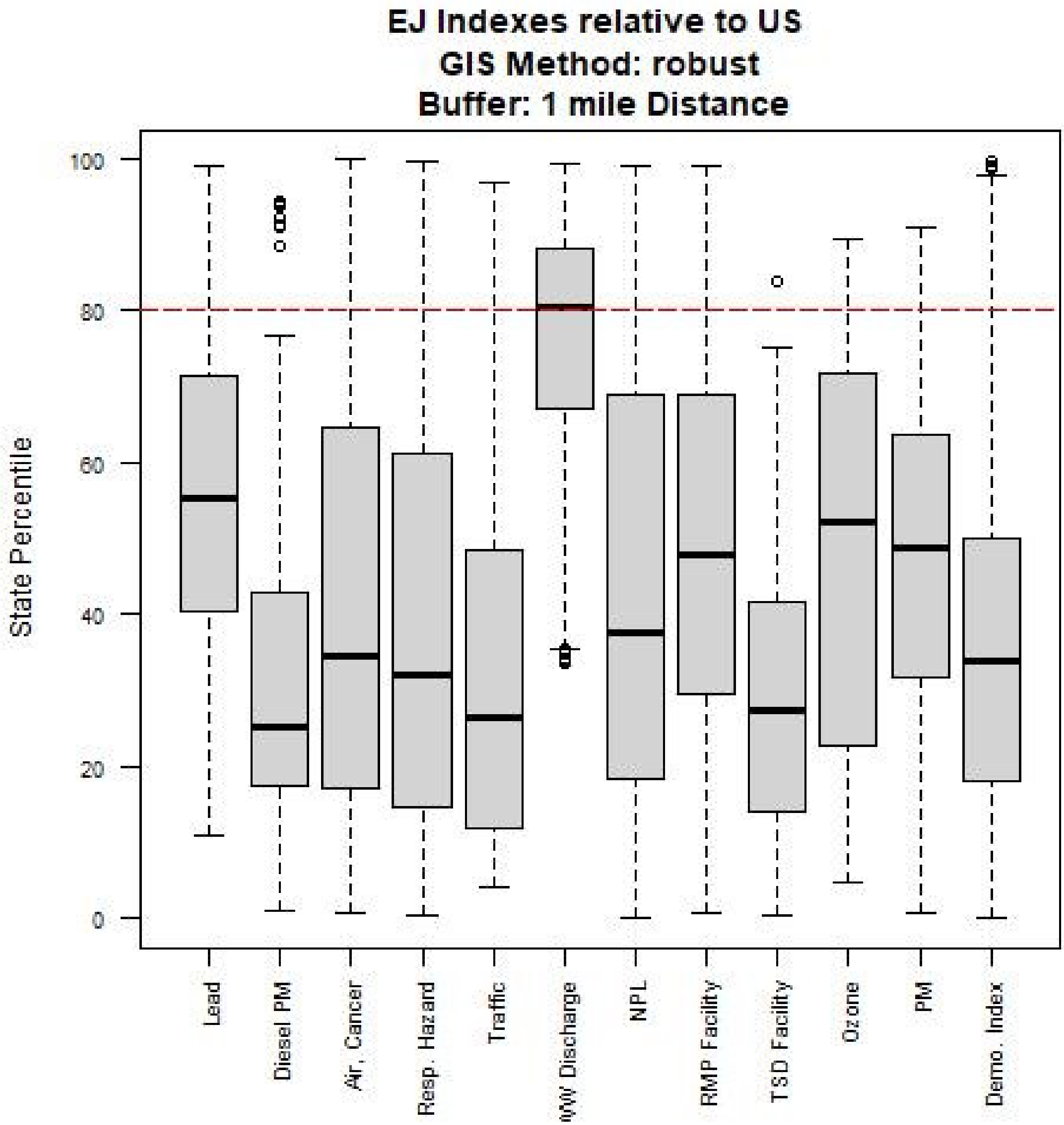


Figure B-8. State Percentile Socioeconomic Indicators Correlation Plot Using A 3-mile Radius

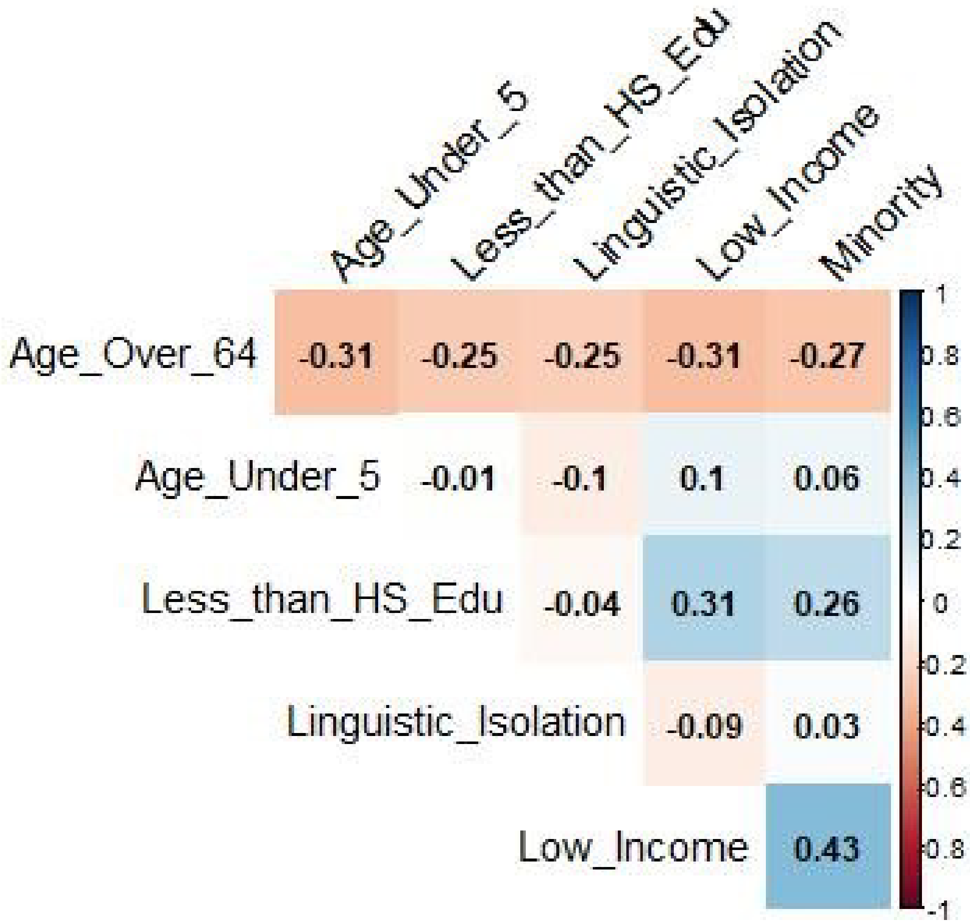


Figure B-9. State Percentile Environmental Indicators Correlation Plot Using A 3-mile Radius

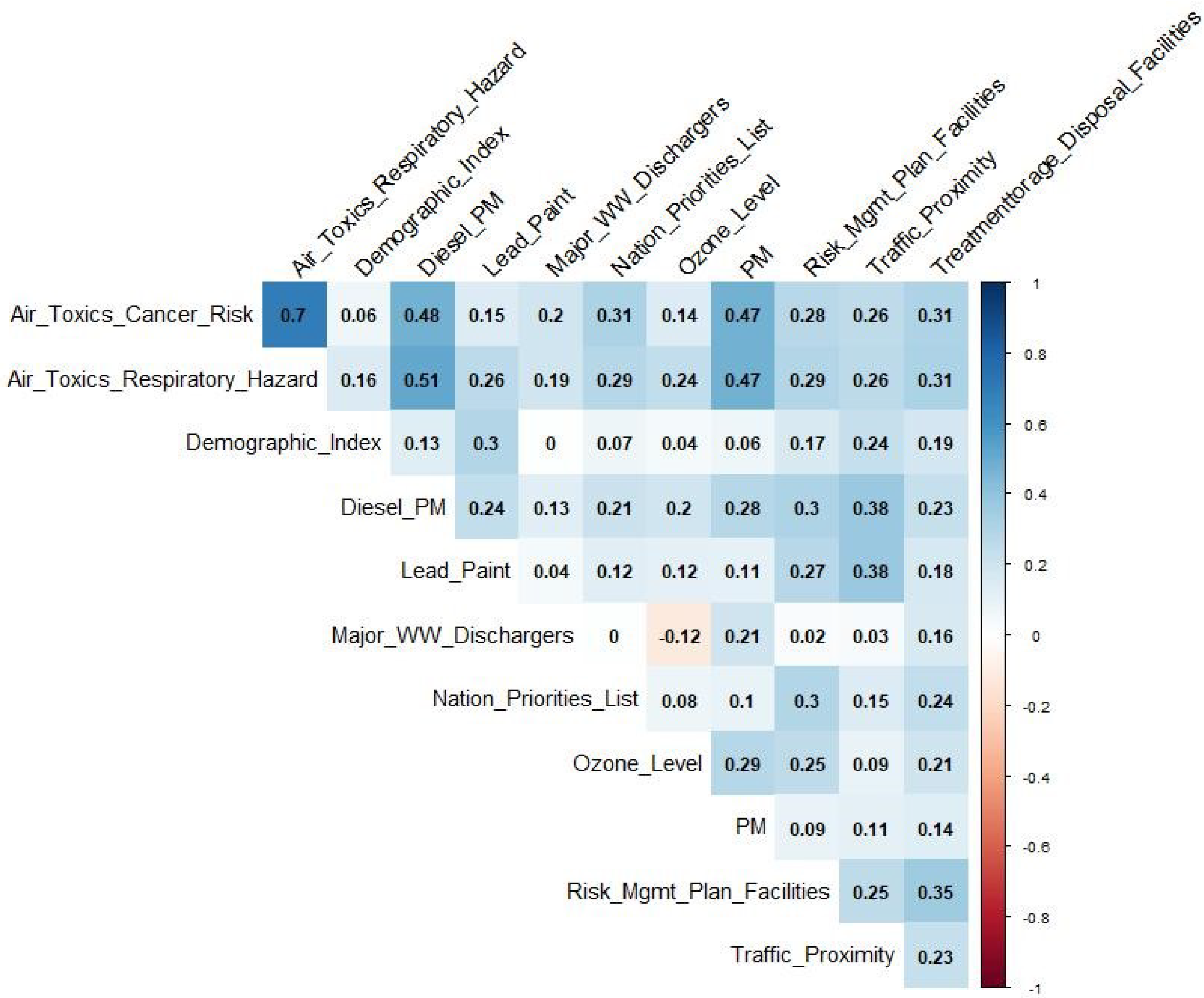


Figure B-10. State Percentile Socioeconomic Indicators Box Plot Using A 3-mile Radius

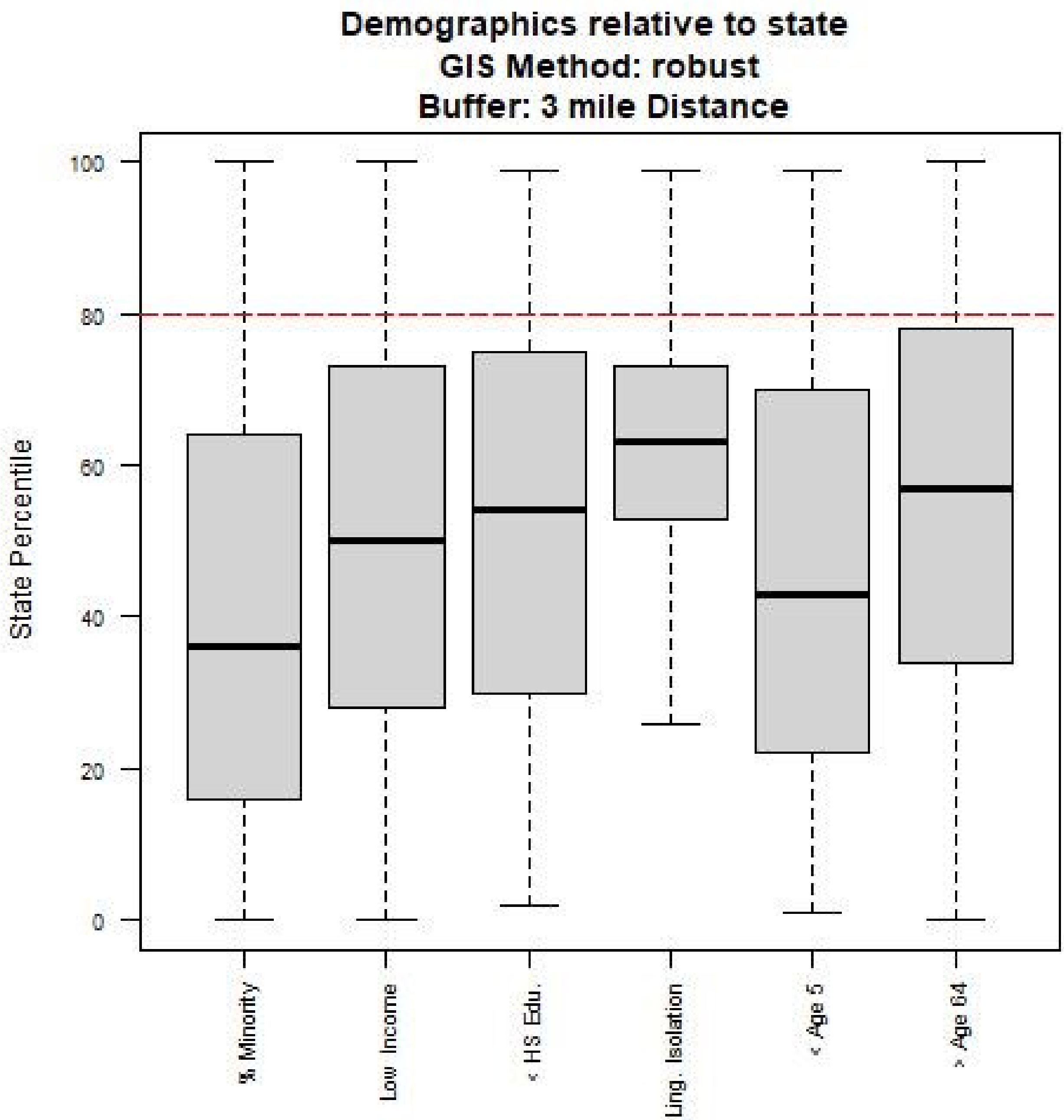


Figure B-11. State Percentile Environmental Indicators Box Plot Using A 3-mile Radius

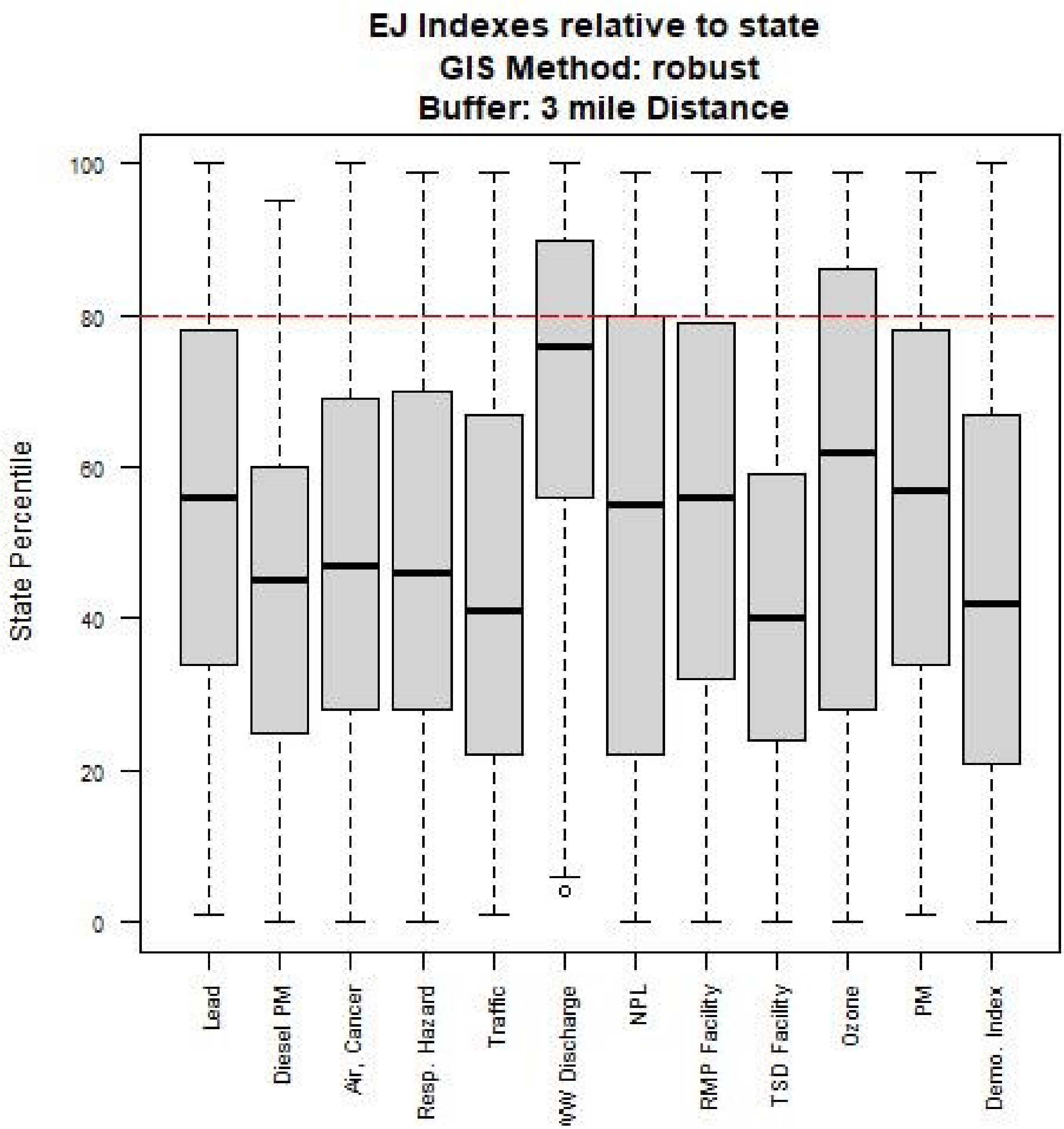


Figure B-12. National Percentile Socioeconomic Indicators Correlation Plot Using A 3-mile Radius

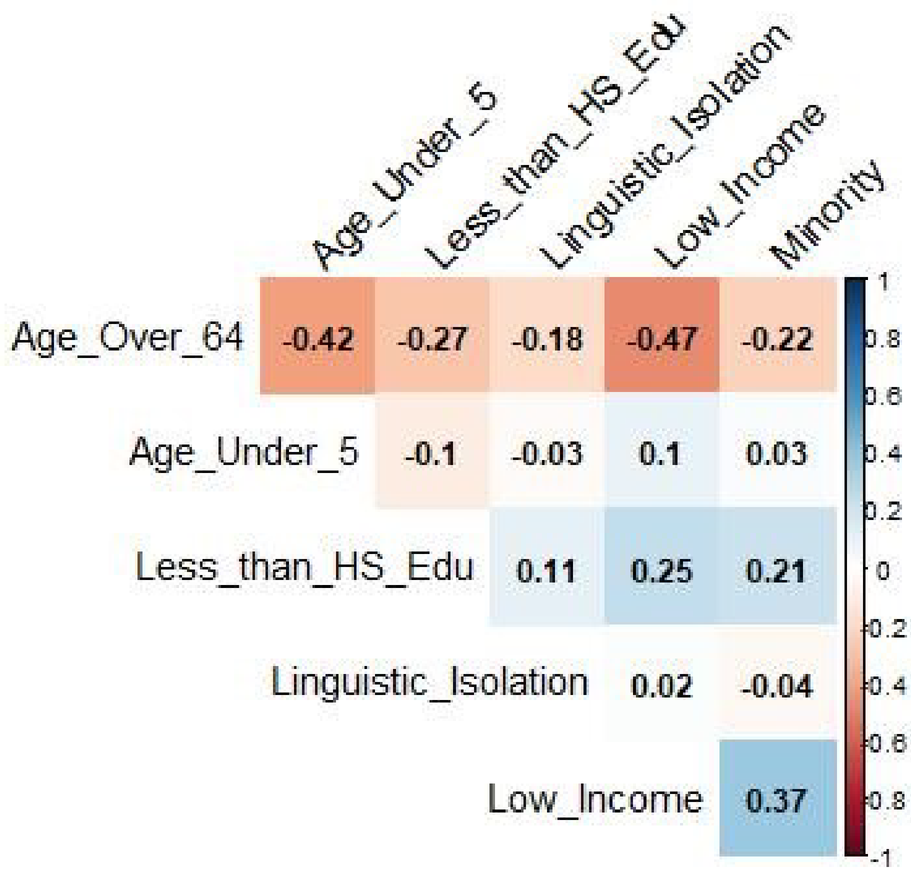


Figure B-13. National Percentile Environmental Indicators Correlation Plot Using A 3-mile Radius

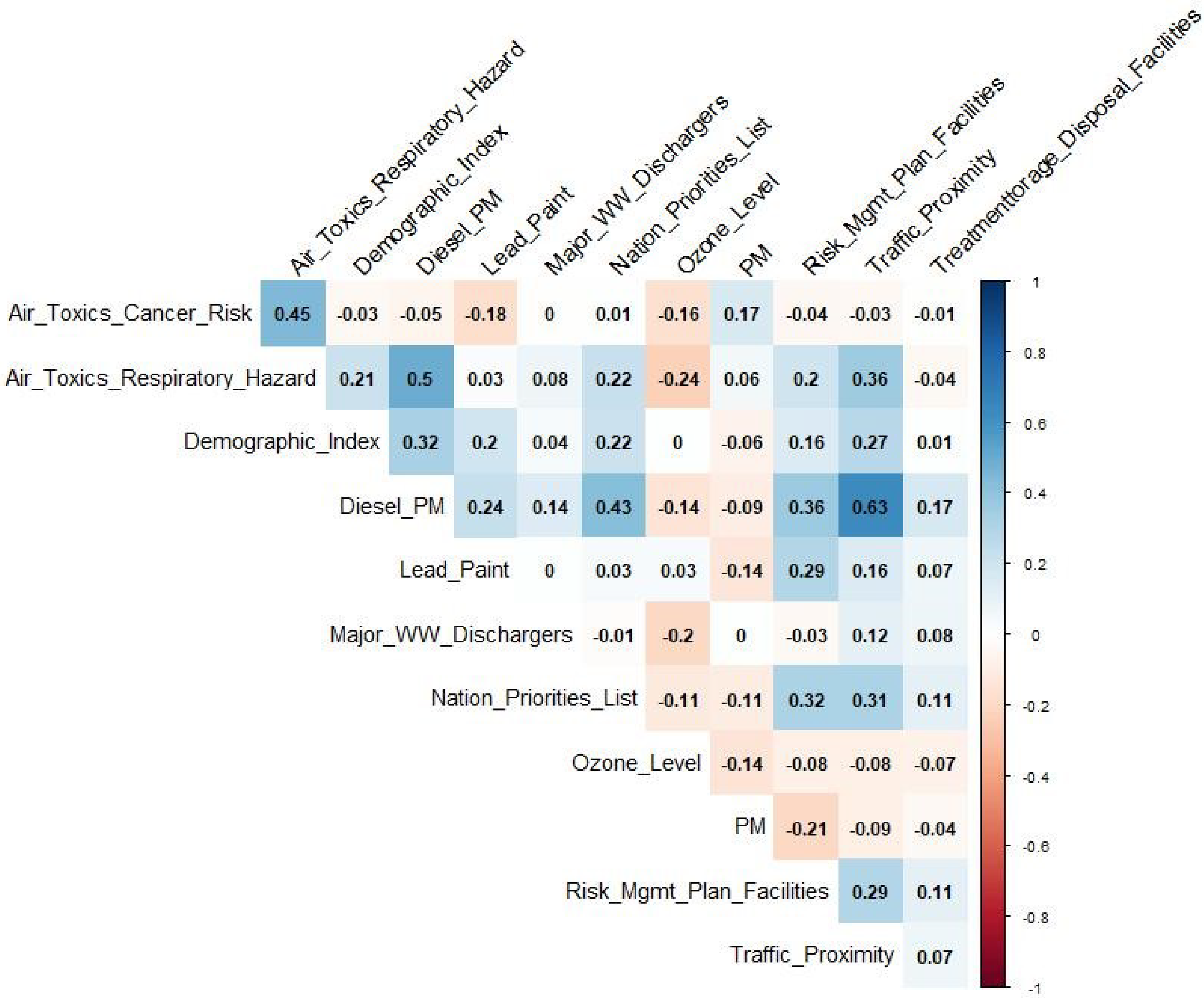


Figure B-14. National Percentile Socioeconomic Indicators Box Plot Using A 3-mile Radius

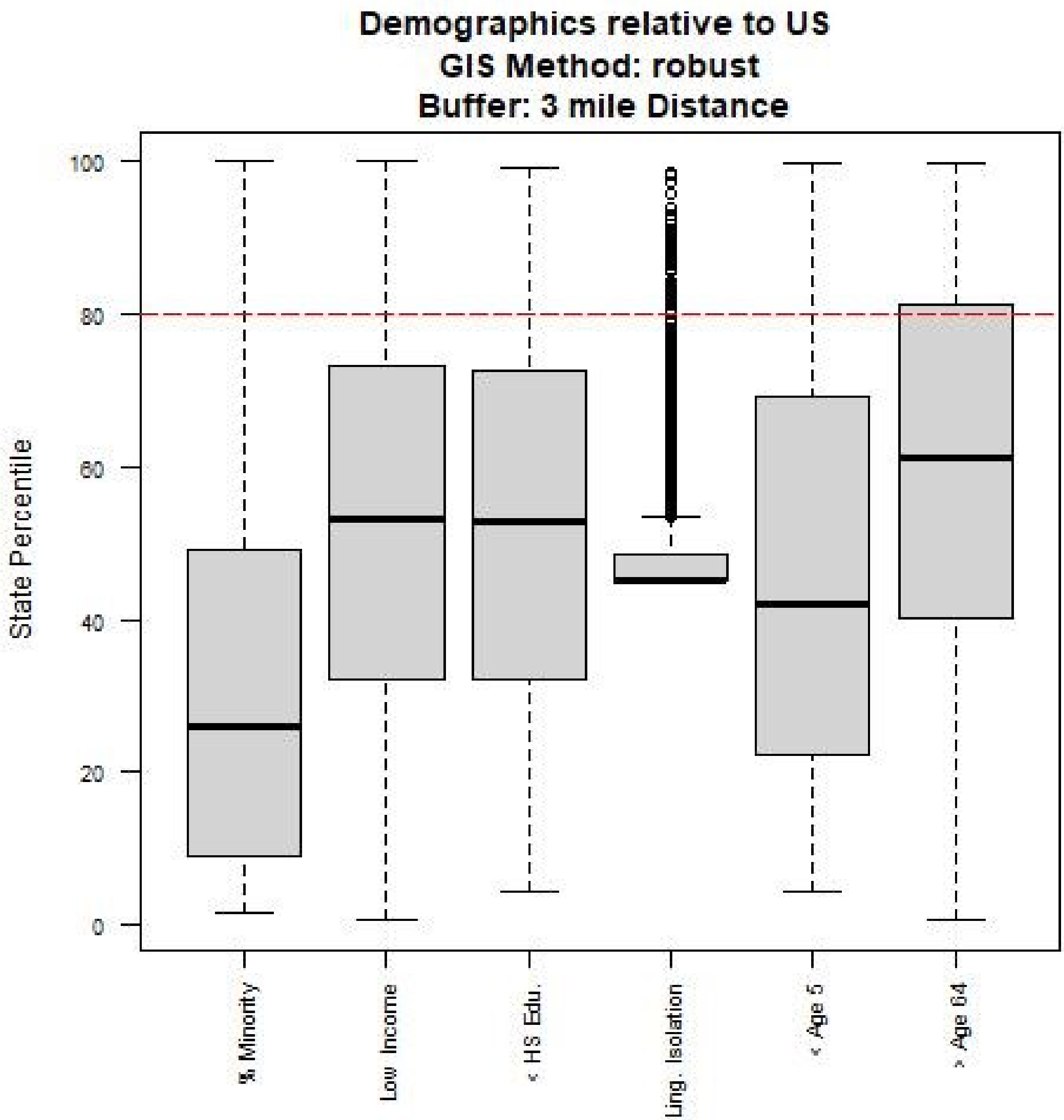
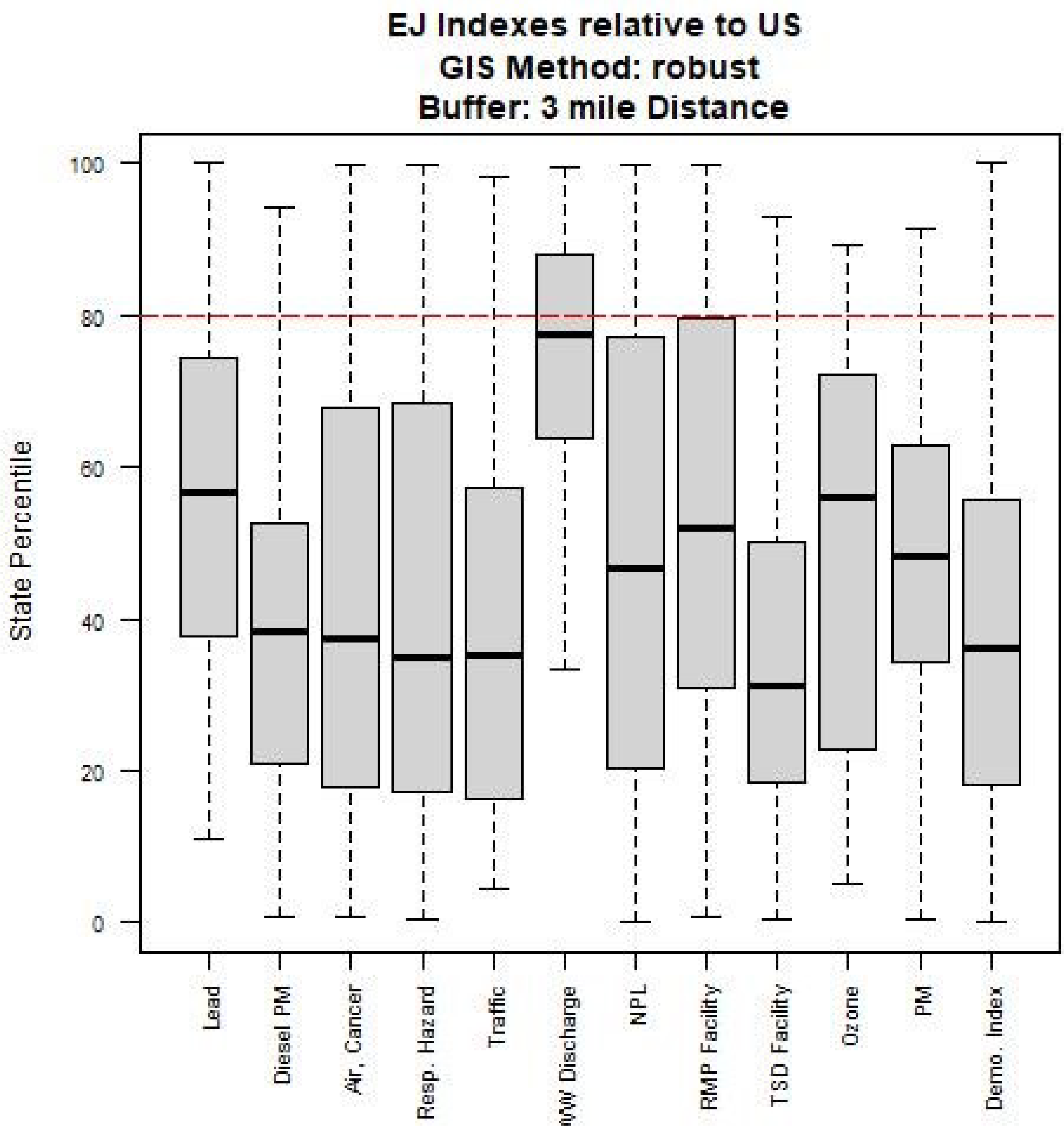


Figure B-15. National Percentile Environmental Indicators Box Plot Using A 3-mile Radius



Section 2: Results from the Downstream Surface Water Screening Analysis

Figure B-16. State Percentile Socioeconomic Indicators Correlation Plot Using A 1-mile Radius

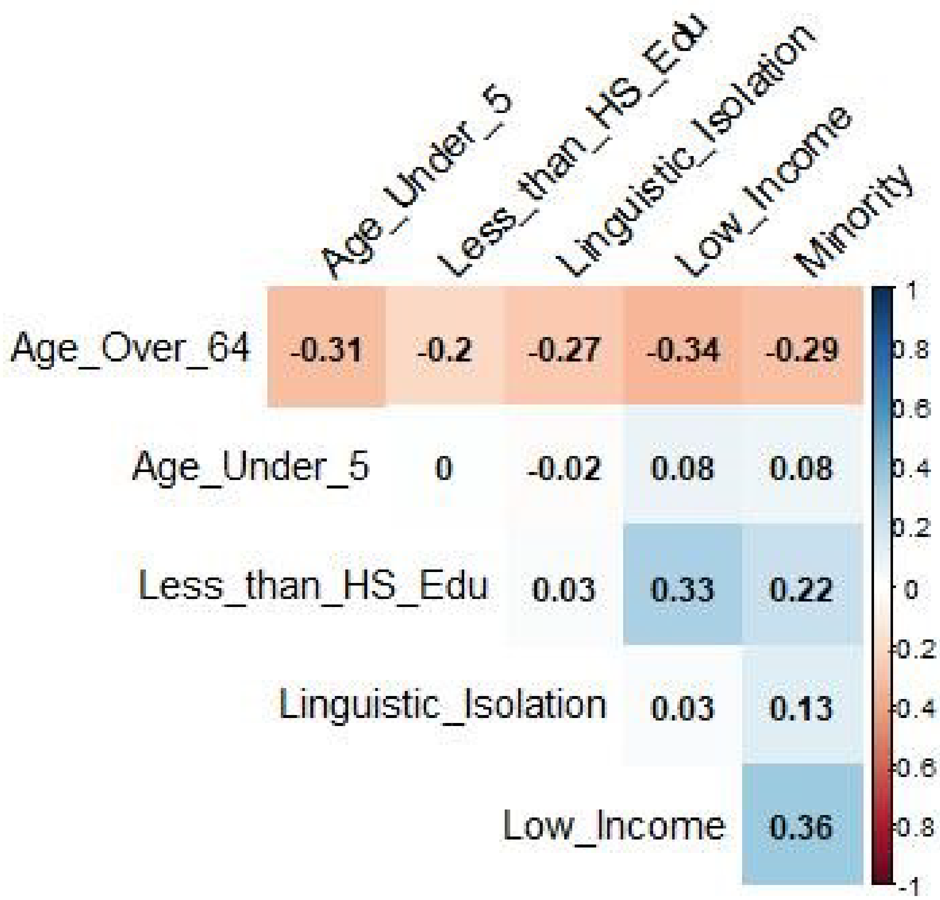


Figure B-17. State Percentile Environmental Indicators Correlation Plot Using A 1-mile Radius

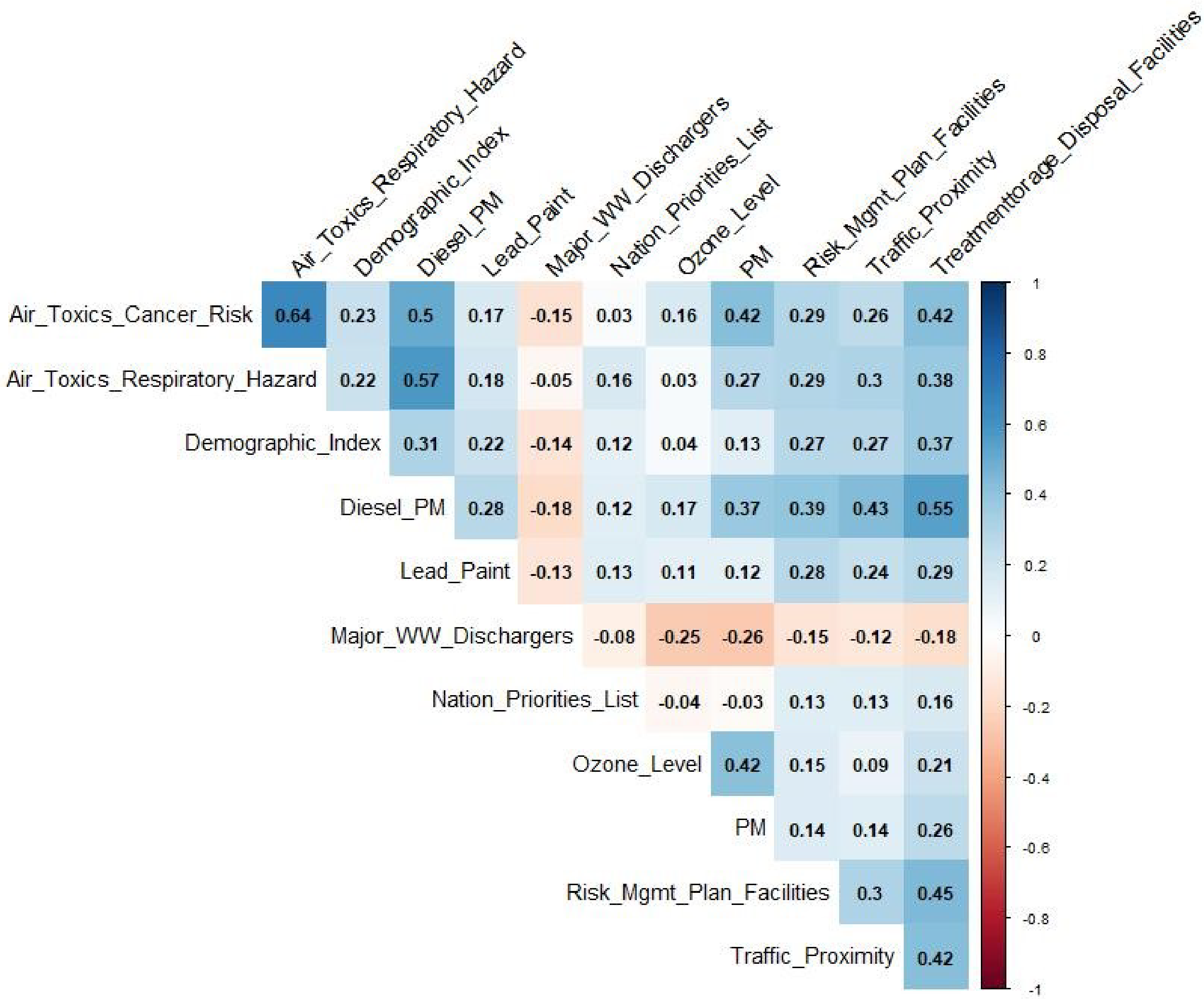


Figure B-18. State Percentile Socioeconomic Indicators Box Plot Using A 1-mile Radius

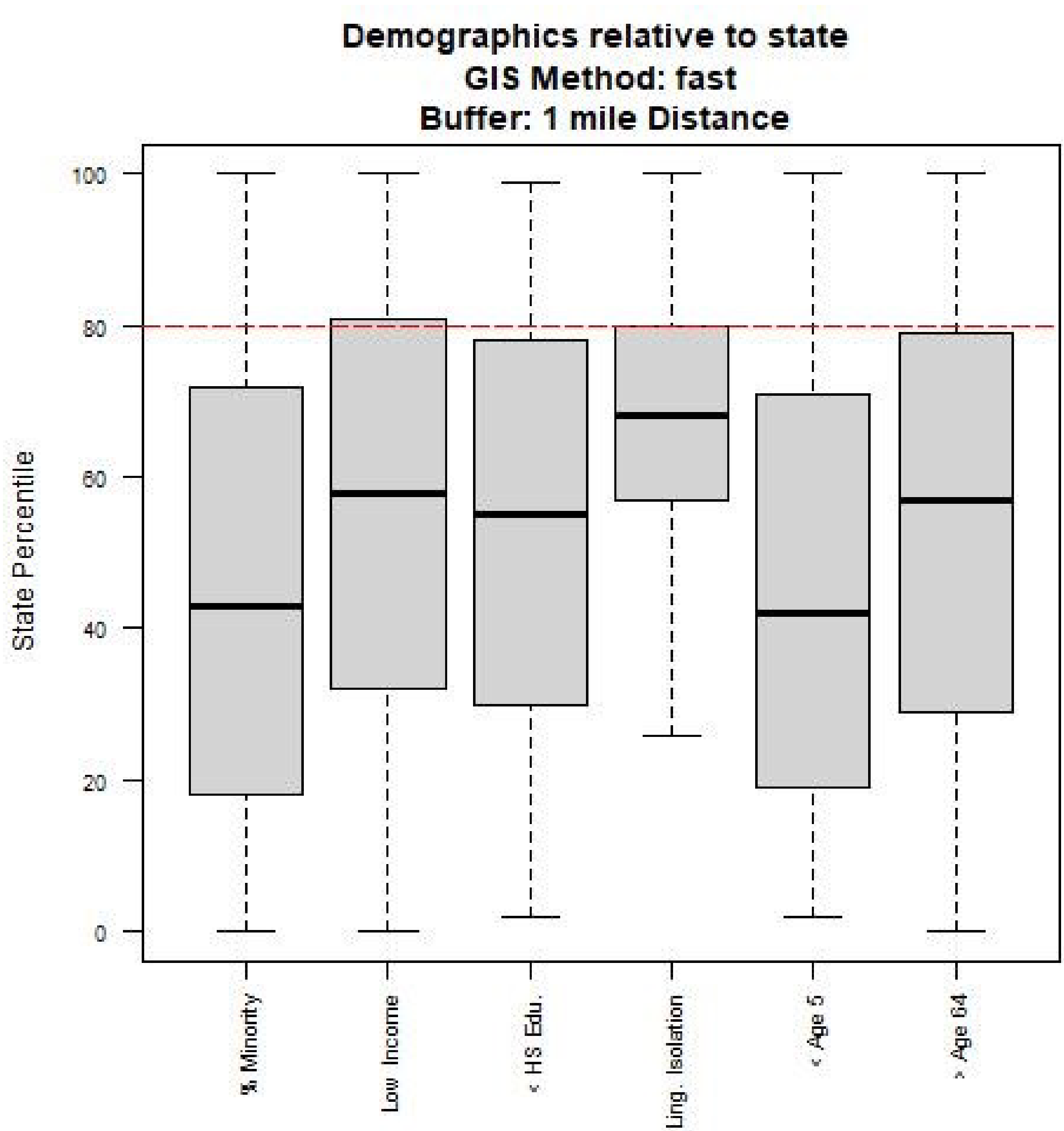


Figure B-19. State Percentile Environmental Indicators Box Plot Using A 1-mile Radius

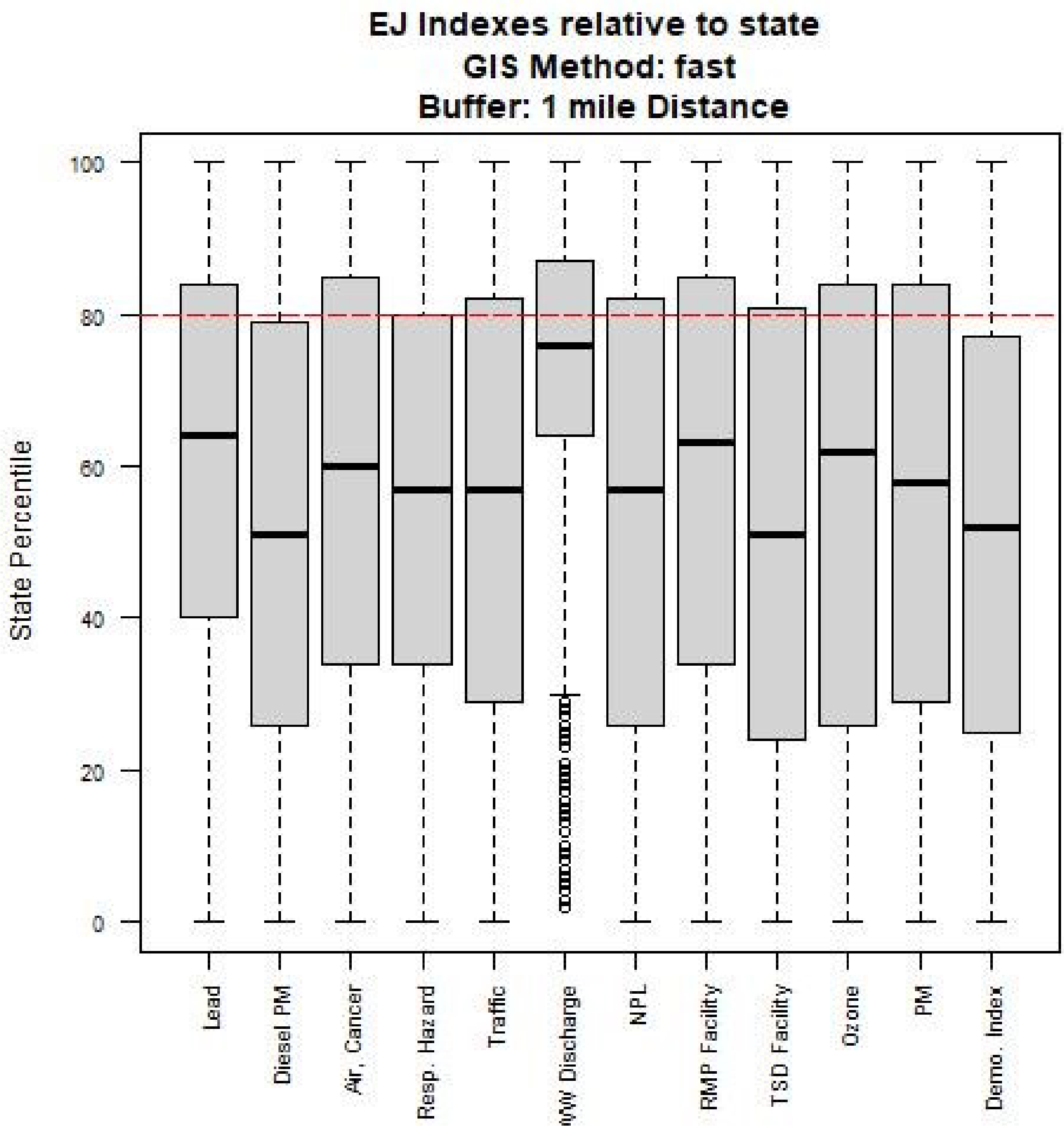


Figure B-20. National Percentile Socioeconomic Indicators Correlation Plot Using A 1-mile Radius

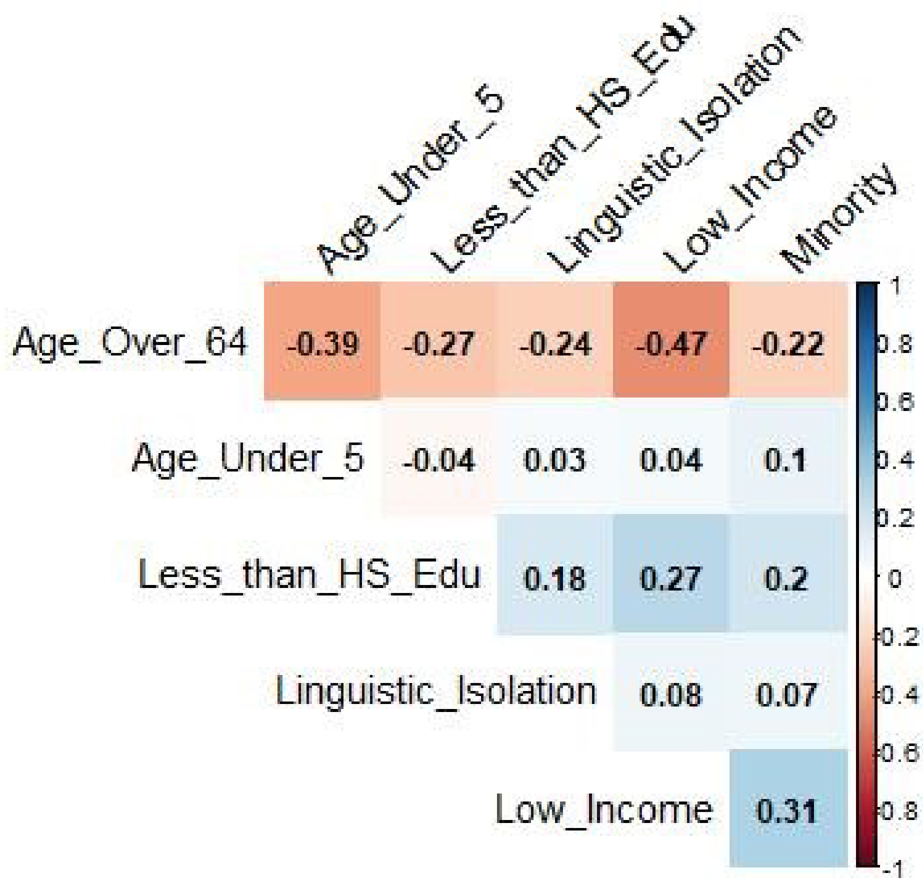


Figure B-21. National Percentile Environmental Indicators Correlation Plot Using A 1-mile Radius

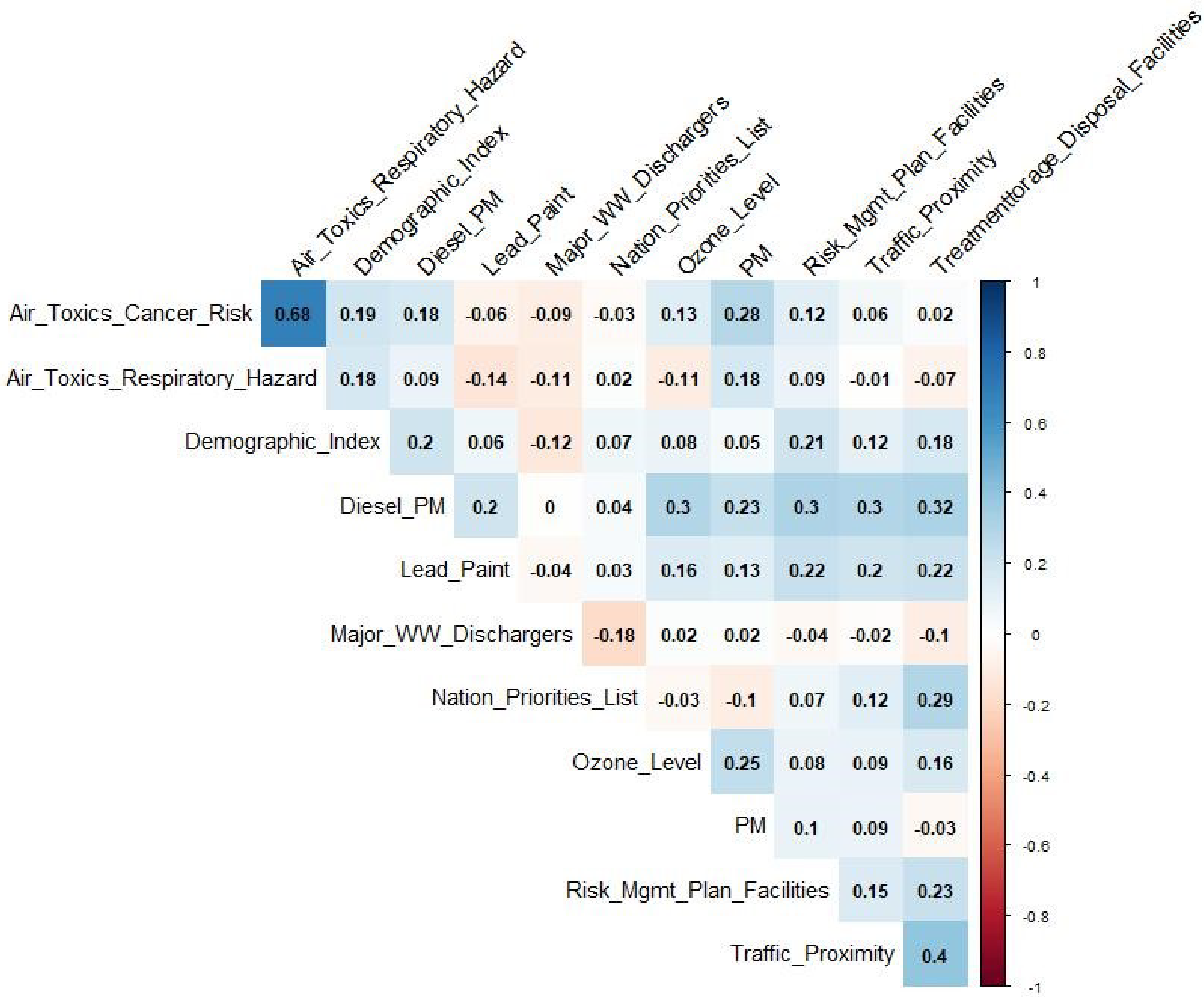


Figure B-22. National Percentile Socioeconomic Indicators Box Plot Using A 1-mile Radius

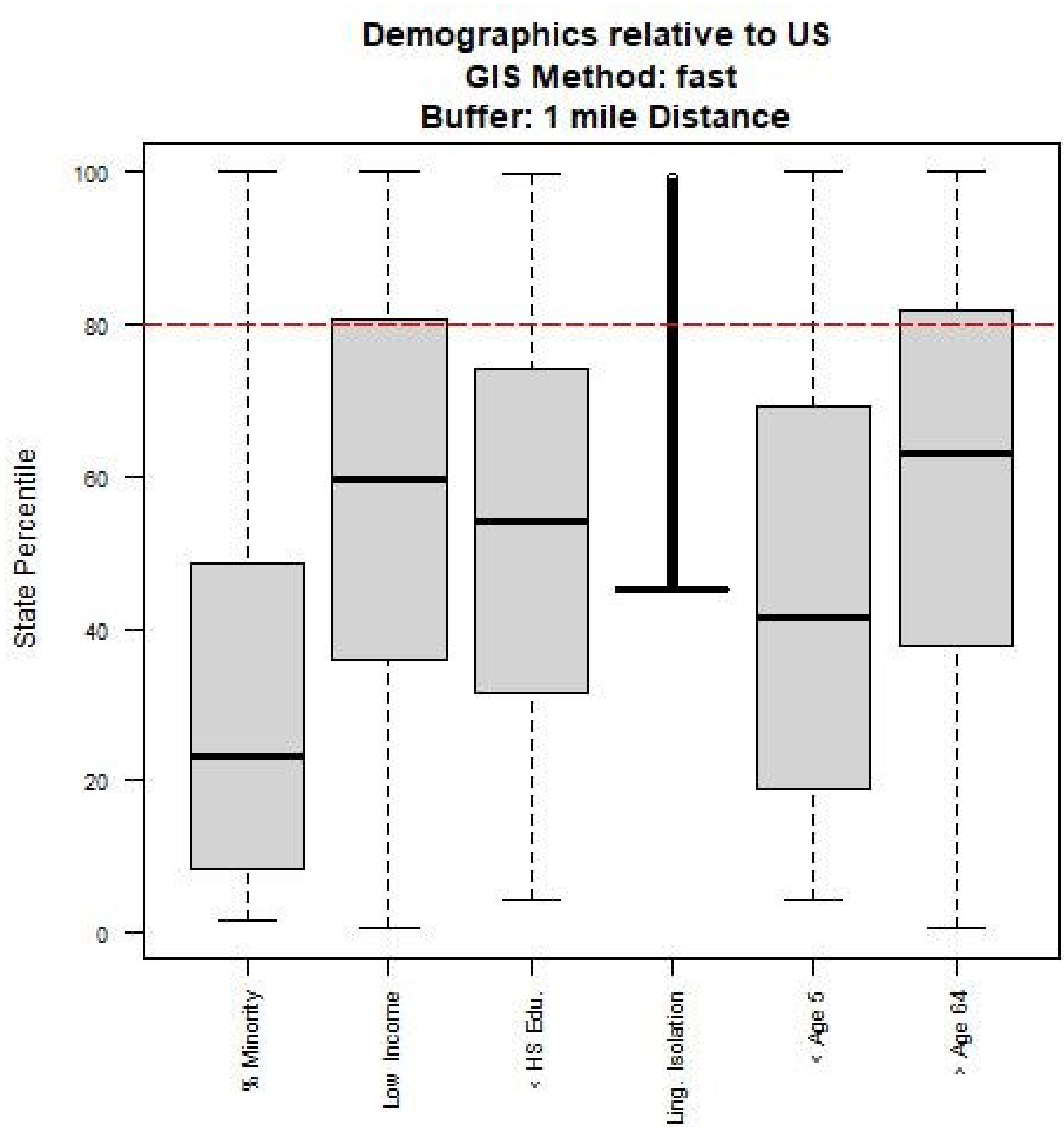


Figure B-23. National Percentile Socioeconomic Indicators Box Plot Using A 1-mile Radius

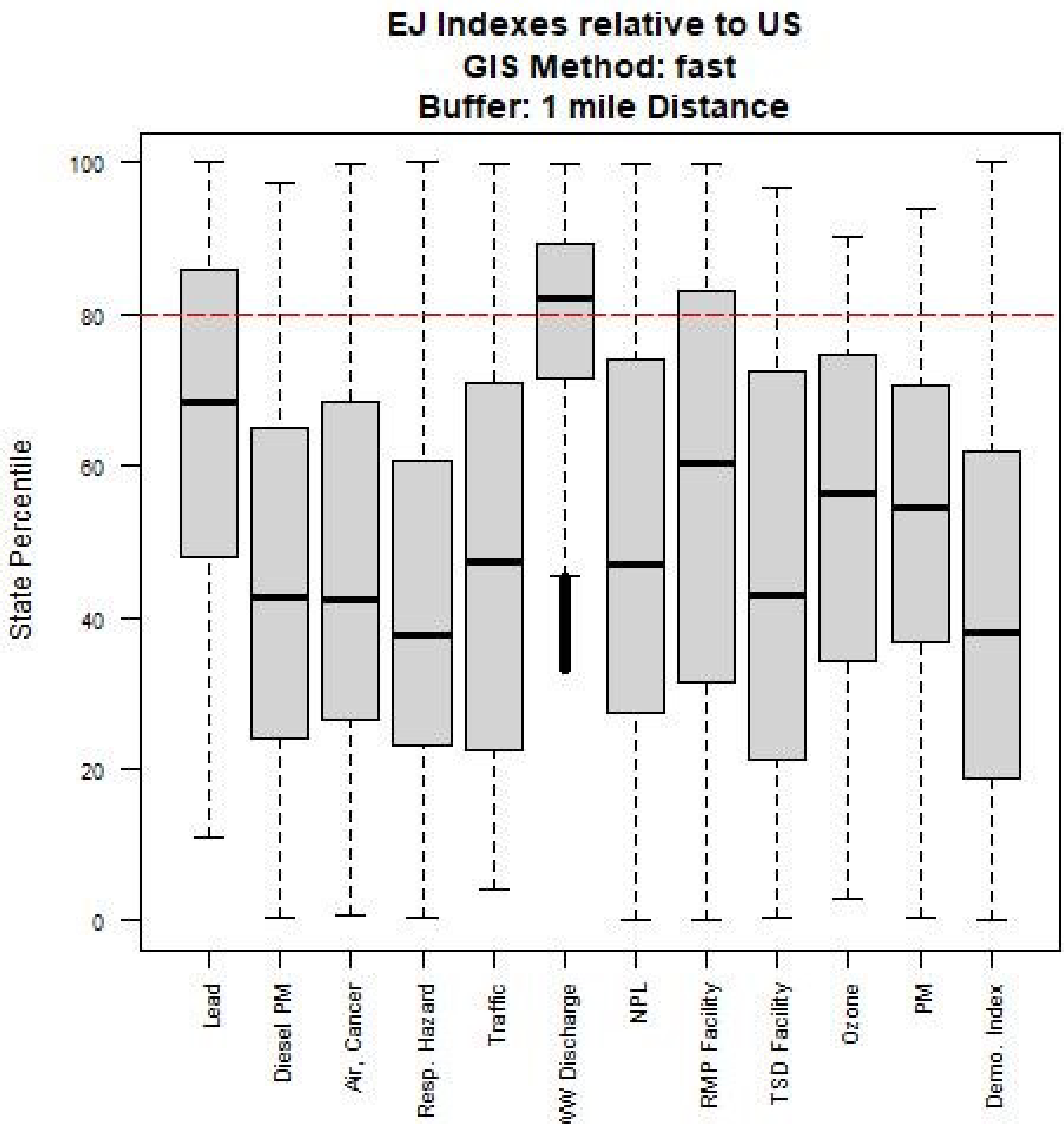


Figure B-24. State Percentile Socioeconomic Indicators Correlation Plot Using A 3-mile Radius

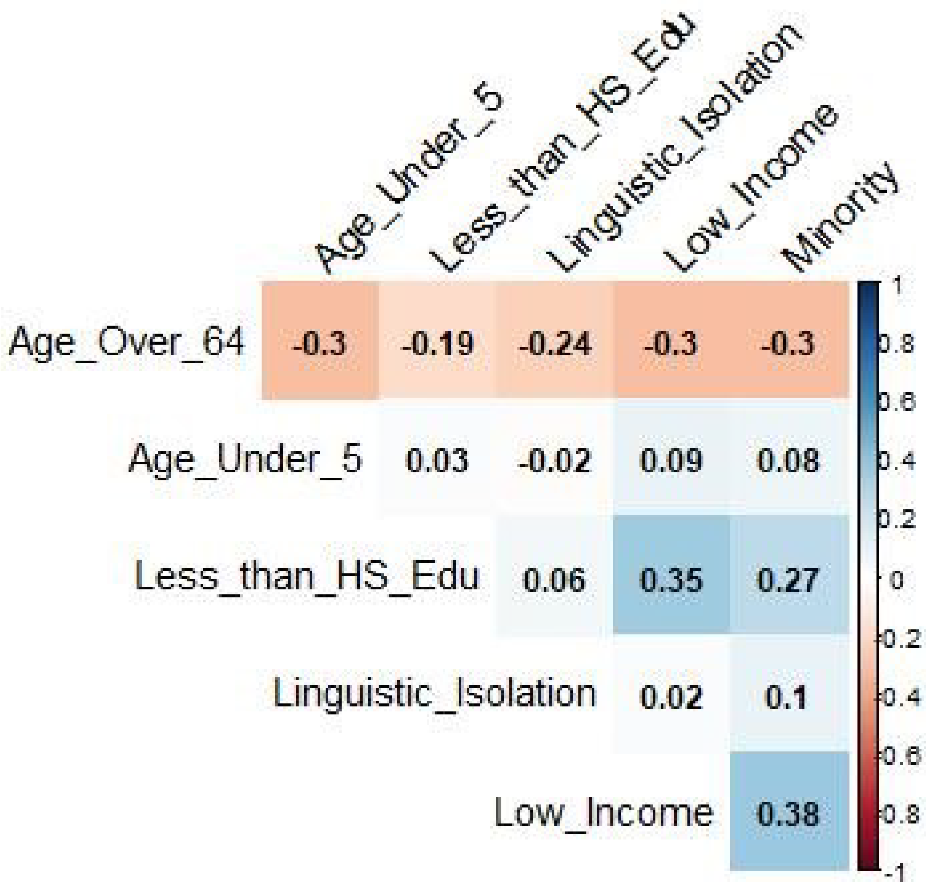


Figure B-25. State Percentile Environmental Indicators Correlation Plot Using A 3-mile Radius

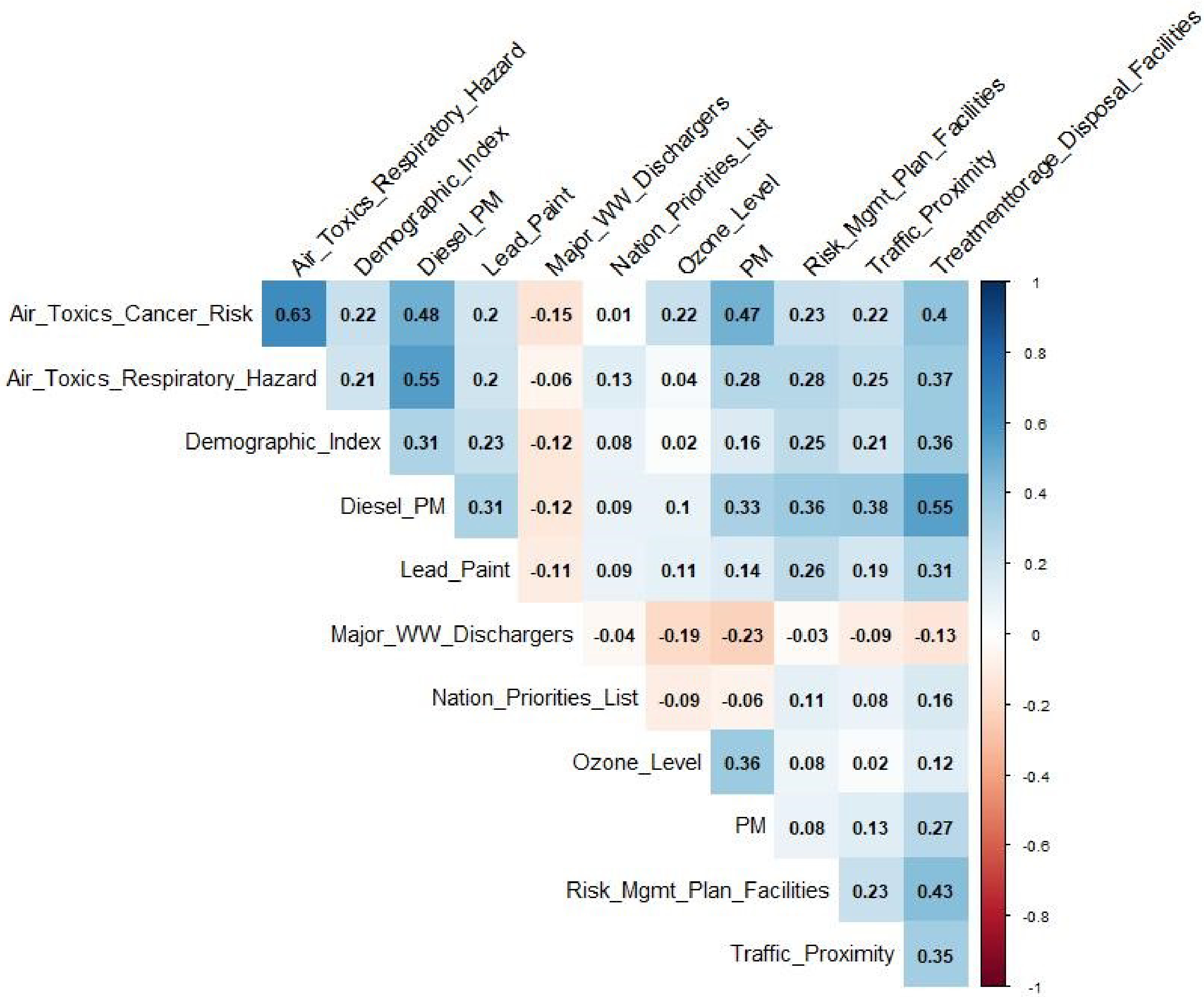


Figure B-26. State Percentile Socioeconomic Indicators Box Plot Using A 3-mile Radius

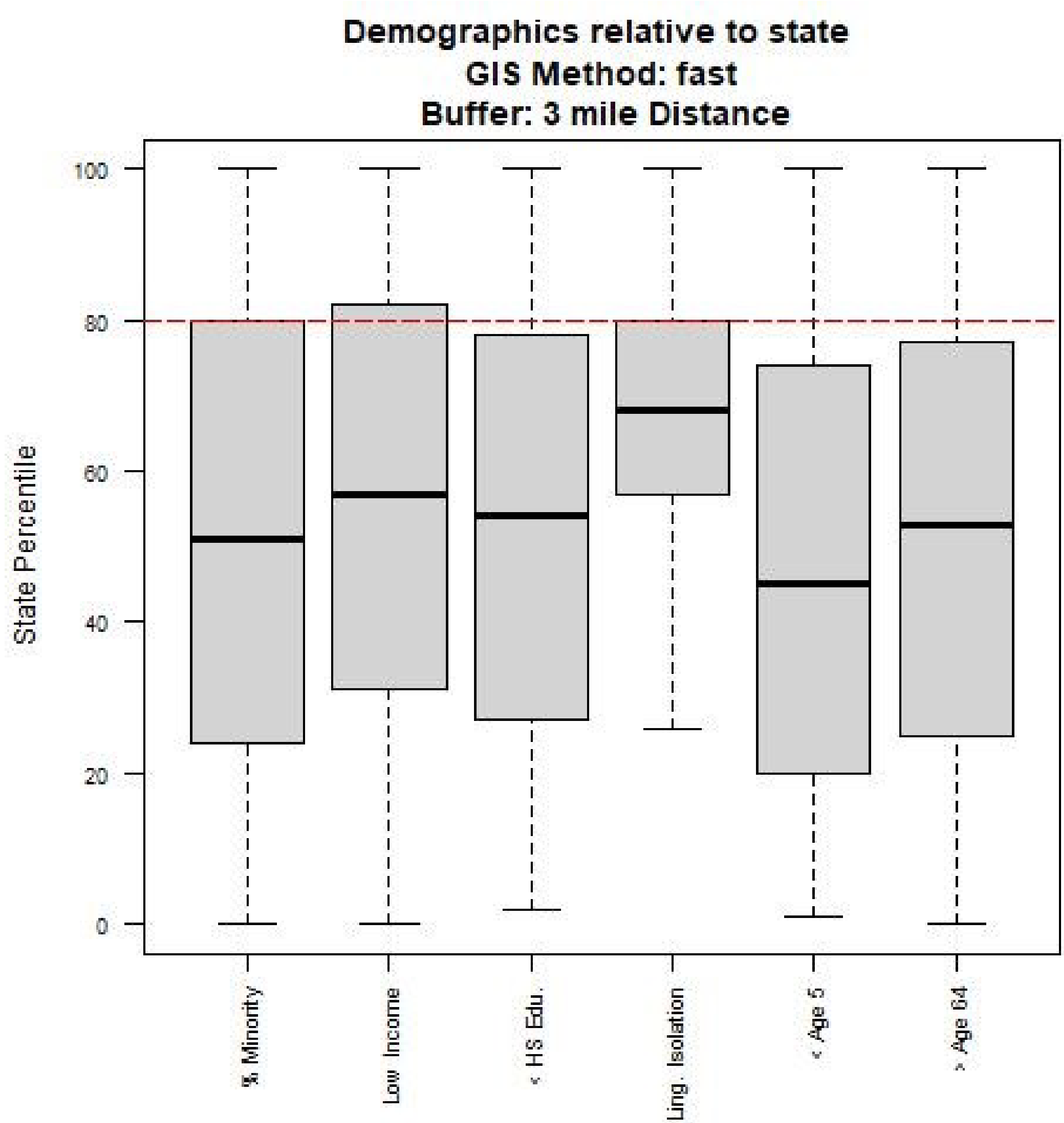


Figure B-27. State Percentile Environmental Indicators Box Plot Using A 3-mile Radius

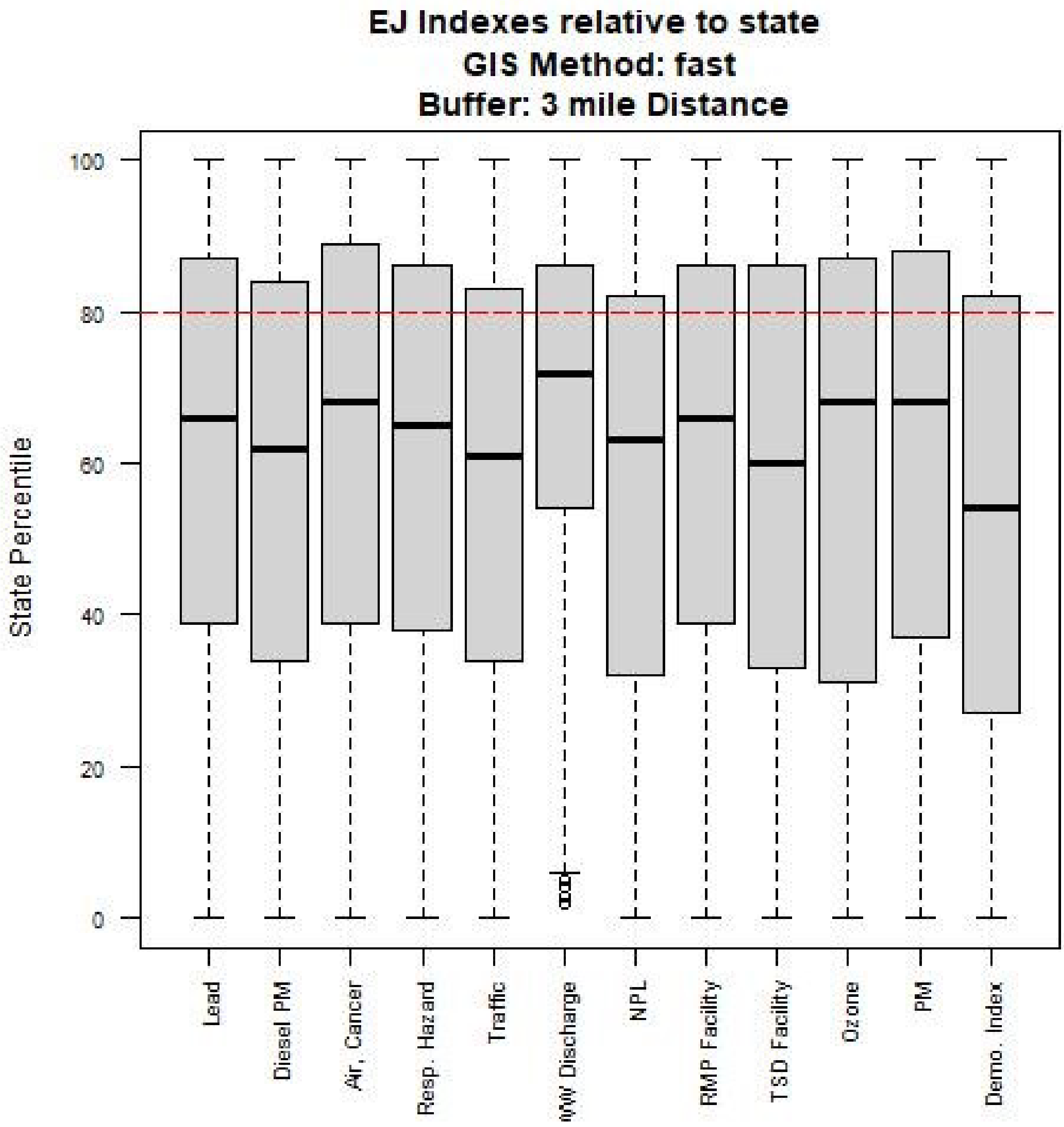


Figure B-28. National Percentile Socioeconomic Indicators Correlation Plot Using A 3-mile Radius

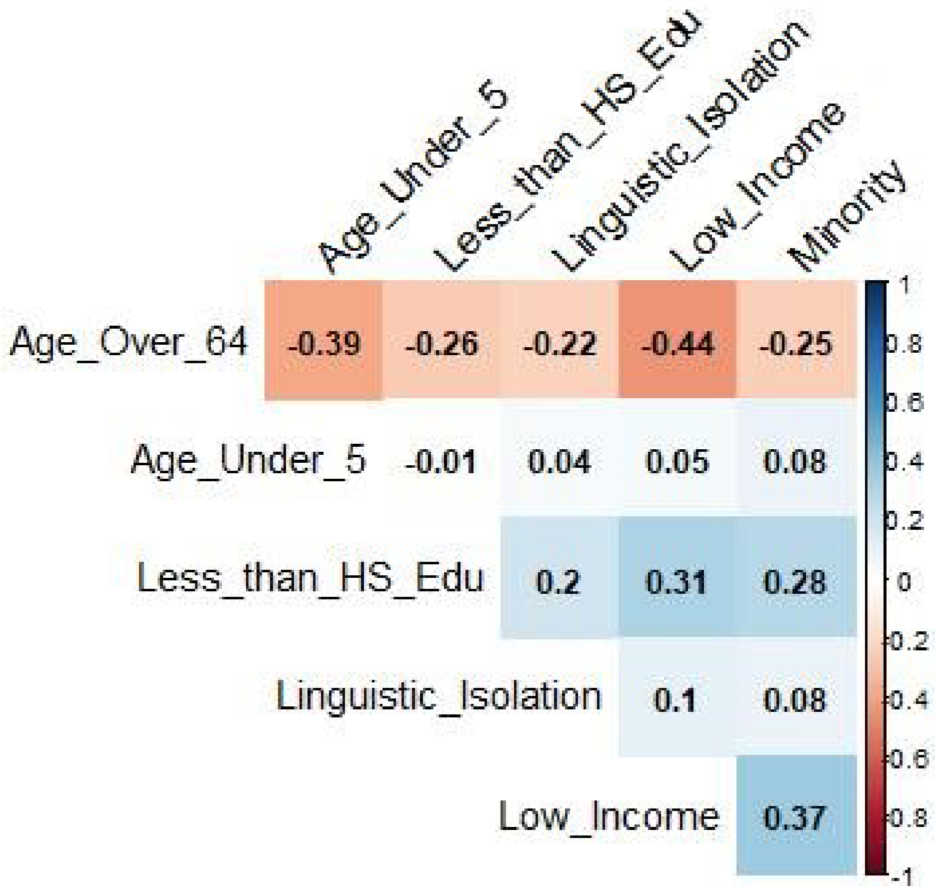


Figure B-29. National Percentile Socioeconomic Indicators Correlation Plot Using A 3-mile Radius

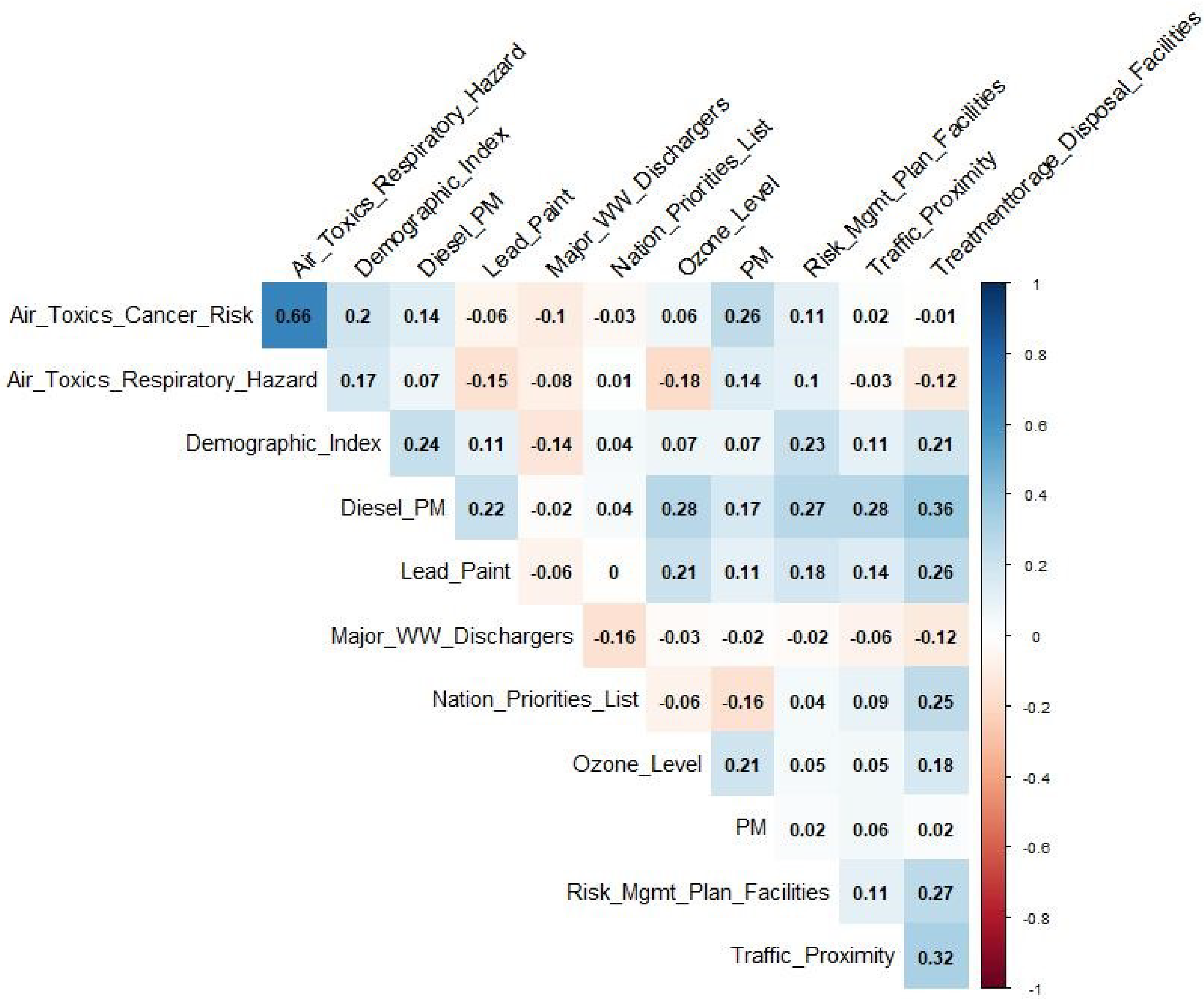


Figure B-30. National Percentile Socioeconomic Indicators Box Plot Using A 3-mile Radius

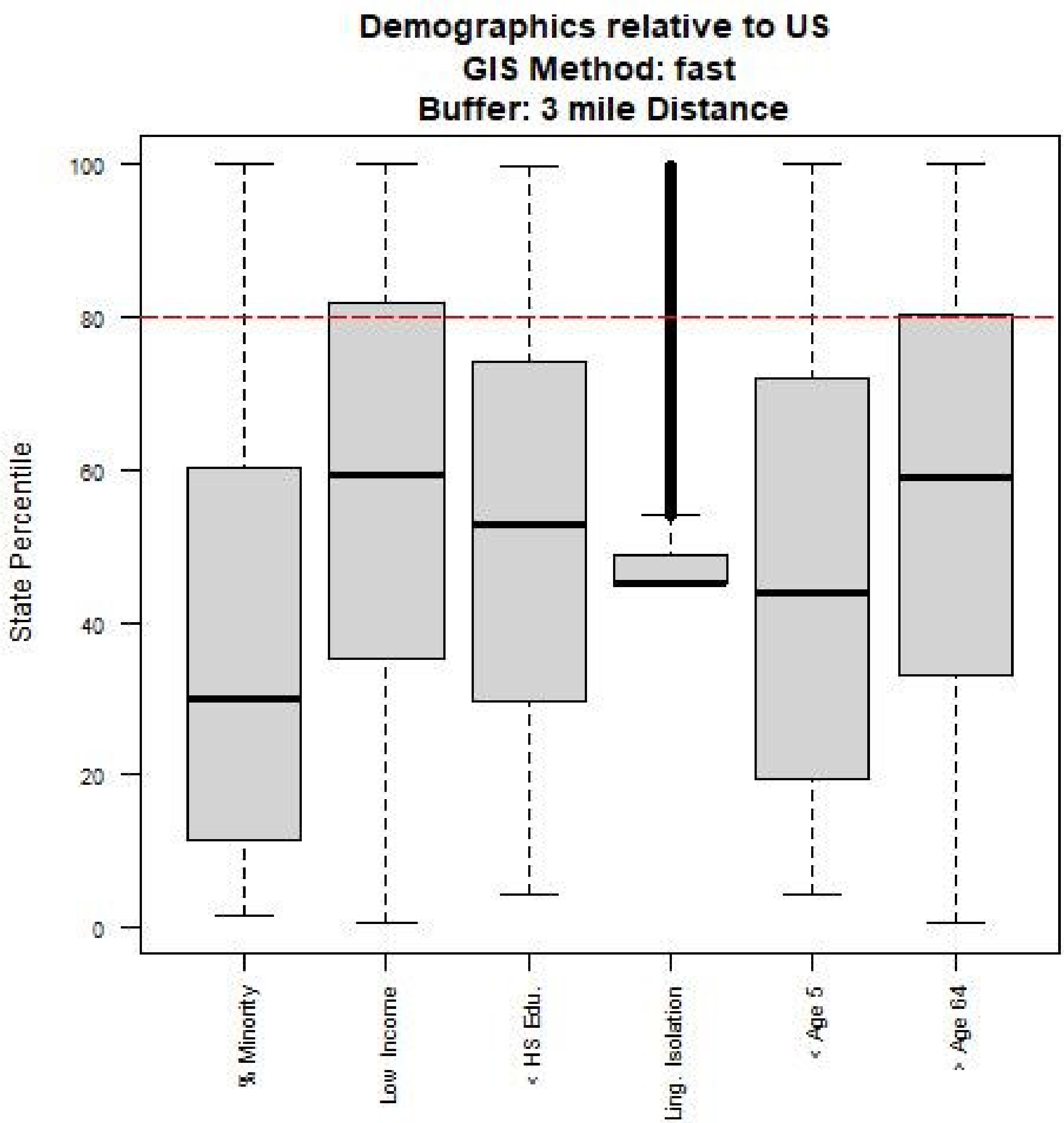


Figure B-31. National Percentile Environmental Indicators Box Plot Using A 3-mile Radius

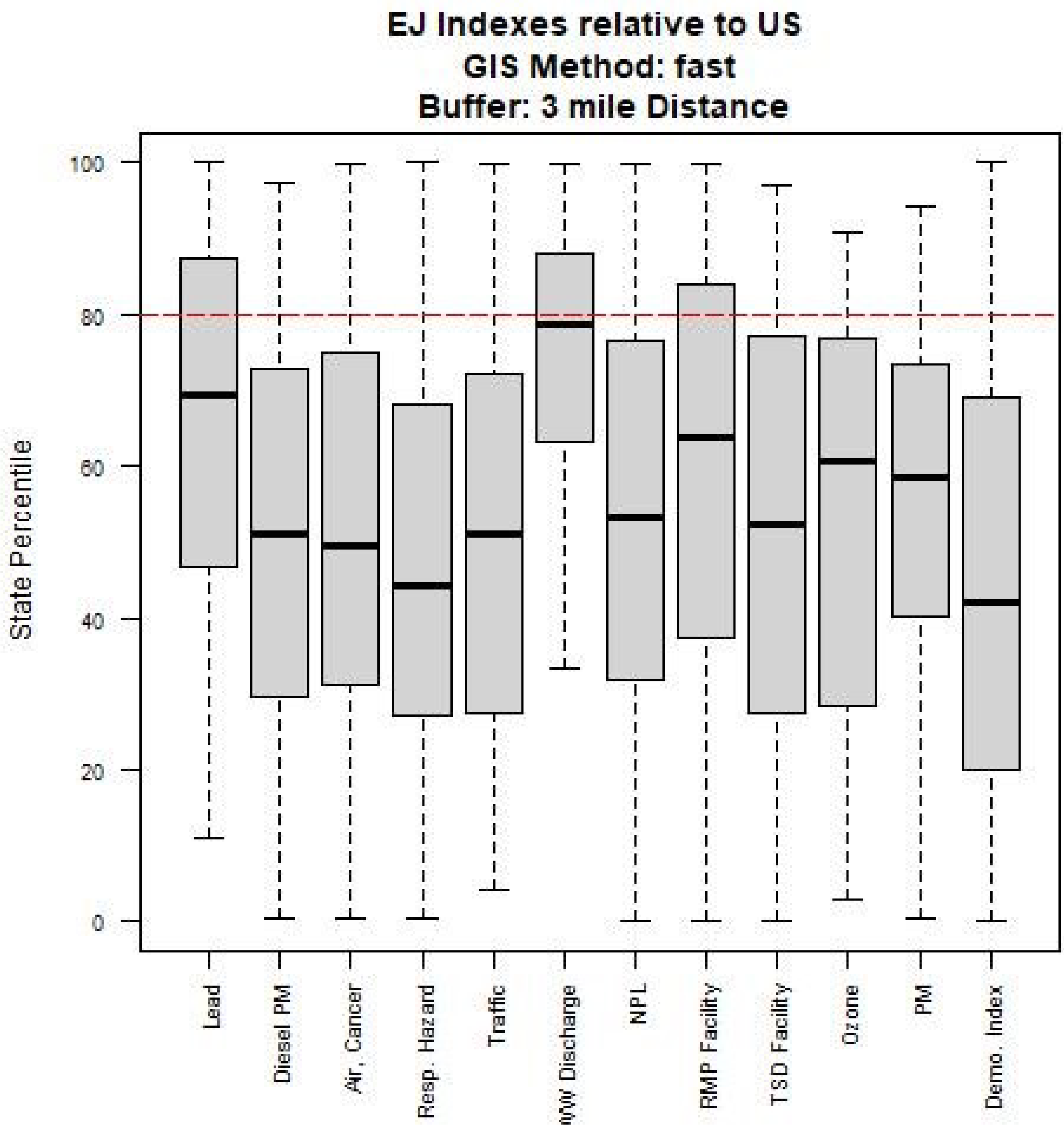


Figure B-32. State Percentile Socioeconomic Indicators Correlation Plot Using A 50-mile Radius

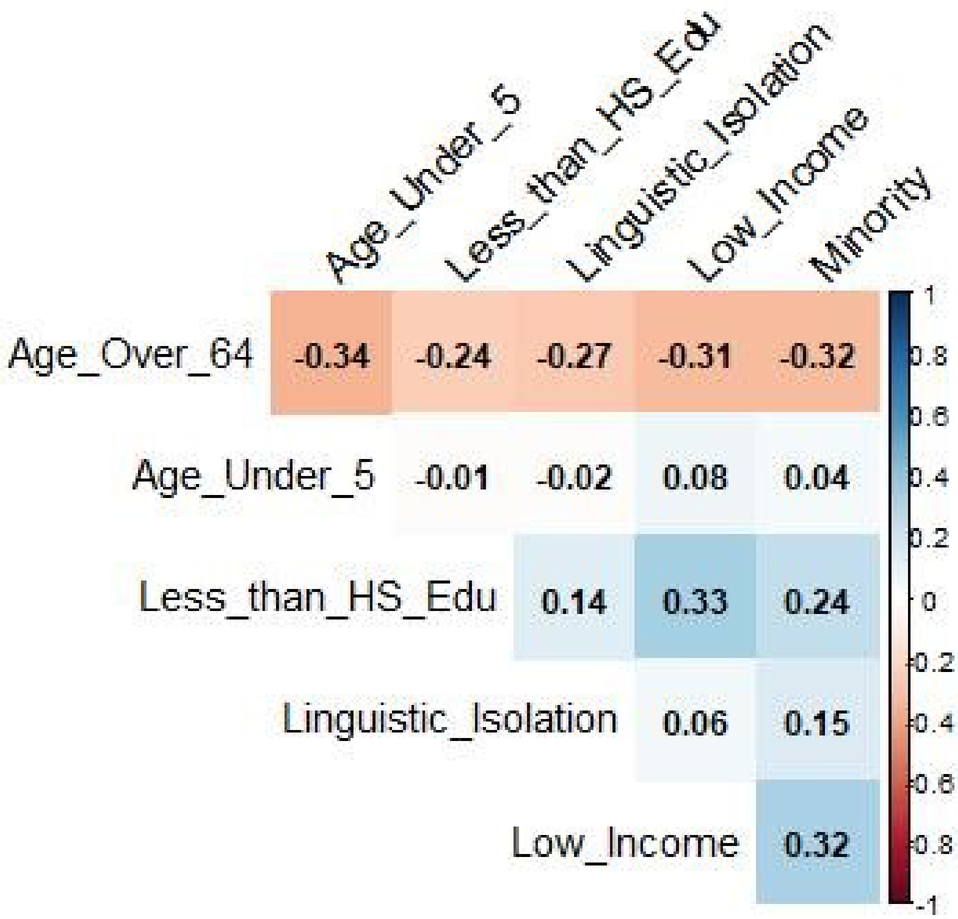


Figure B-33. State Percentile Environmental Indicators Correlation Plot Using A 50-mile Radius

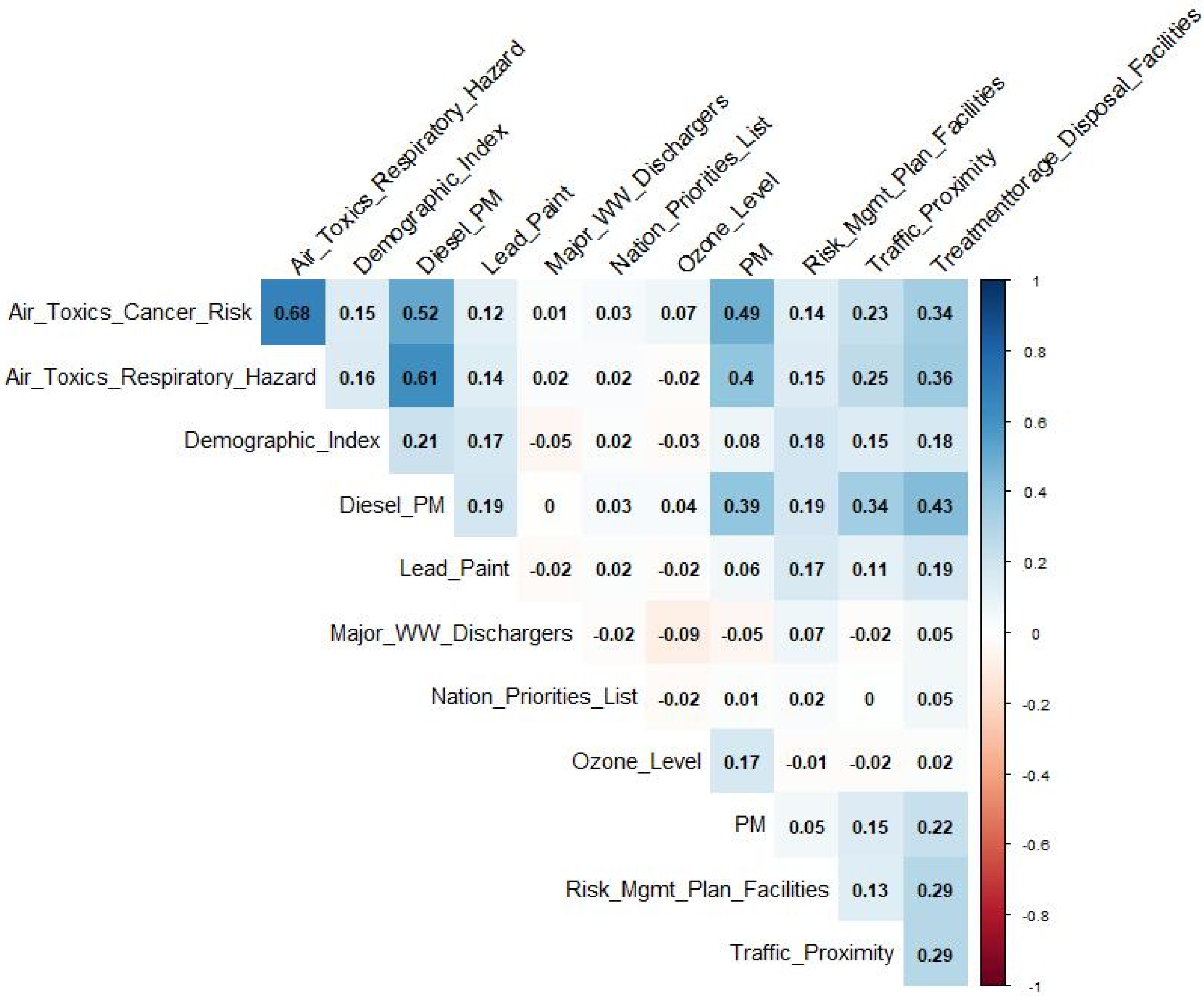


Figure B-34. State Percentile Socioeconomic Indicators Box Plot Using A 50-mile Radius

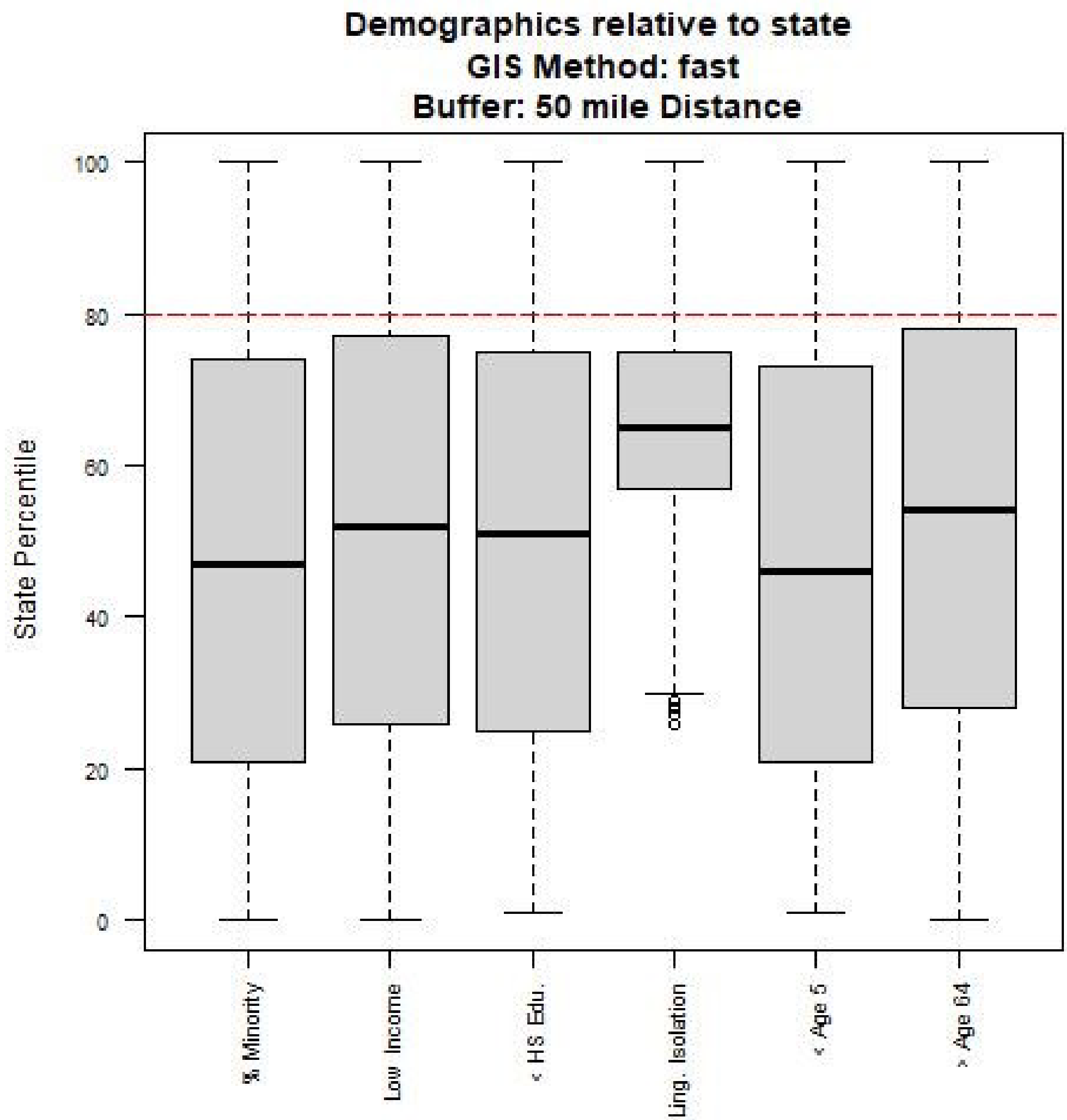


Figure B-35. State Percentile Environmental Indicators Box Plot Using A 50-mile Radius

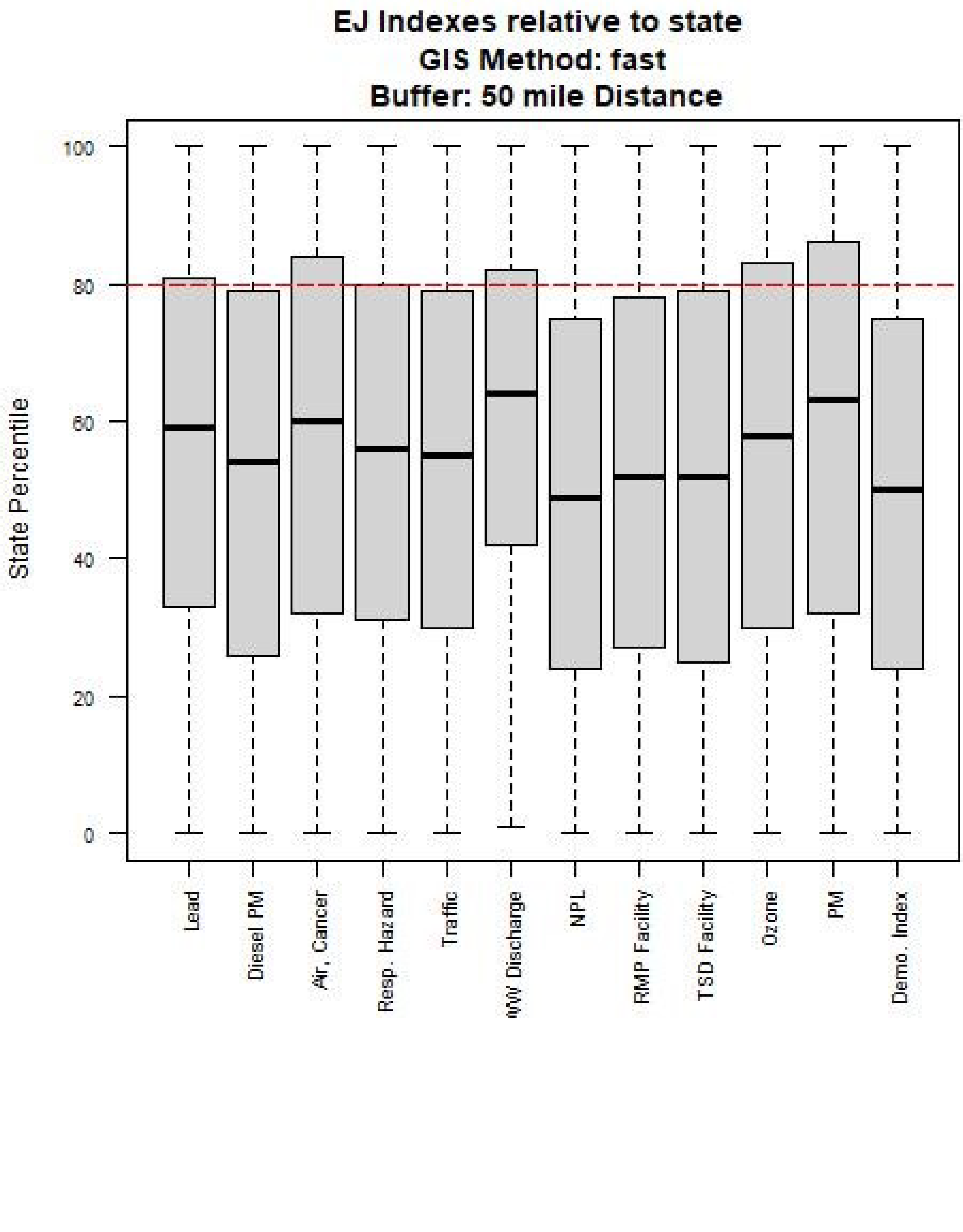


Figure B-36. National Percentile Socioeconomic Indicators Correlation Plot Using A 50-mile Radius

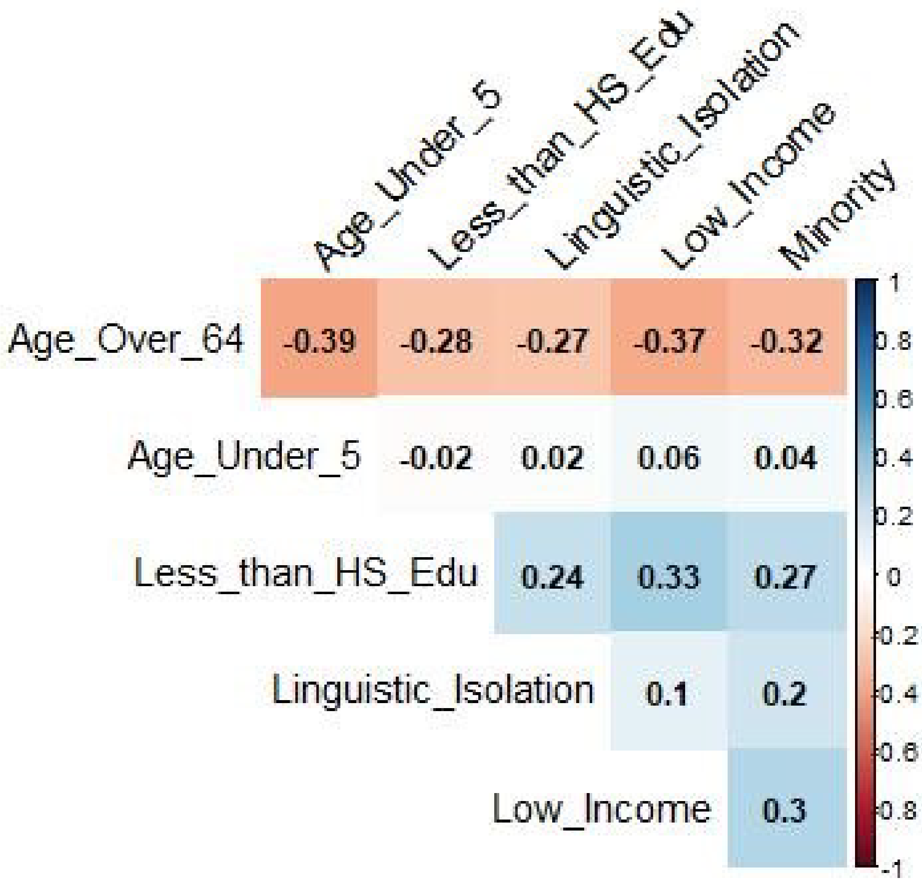


Figure B-37. National Percentile Environmental Indicators Correlation Plot Using A 50-mile Radius

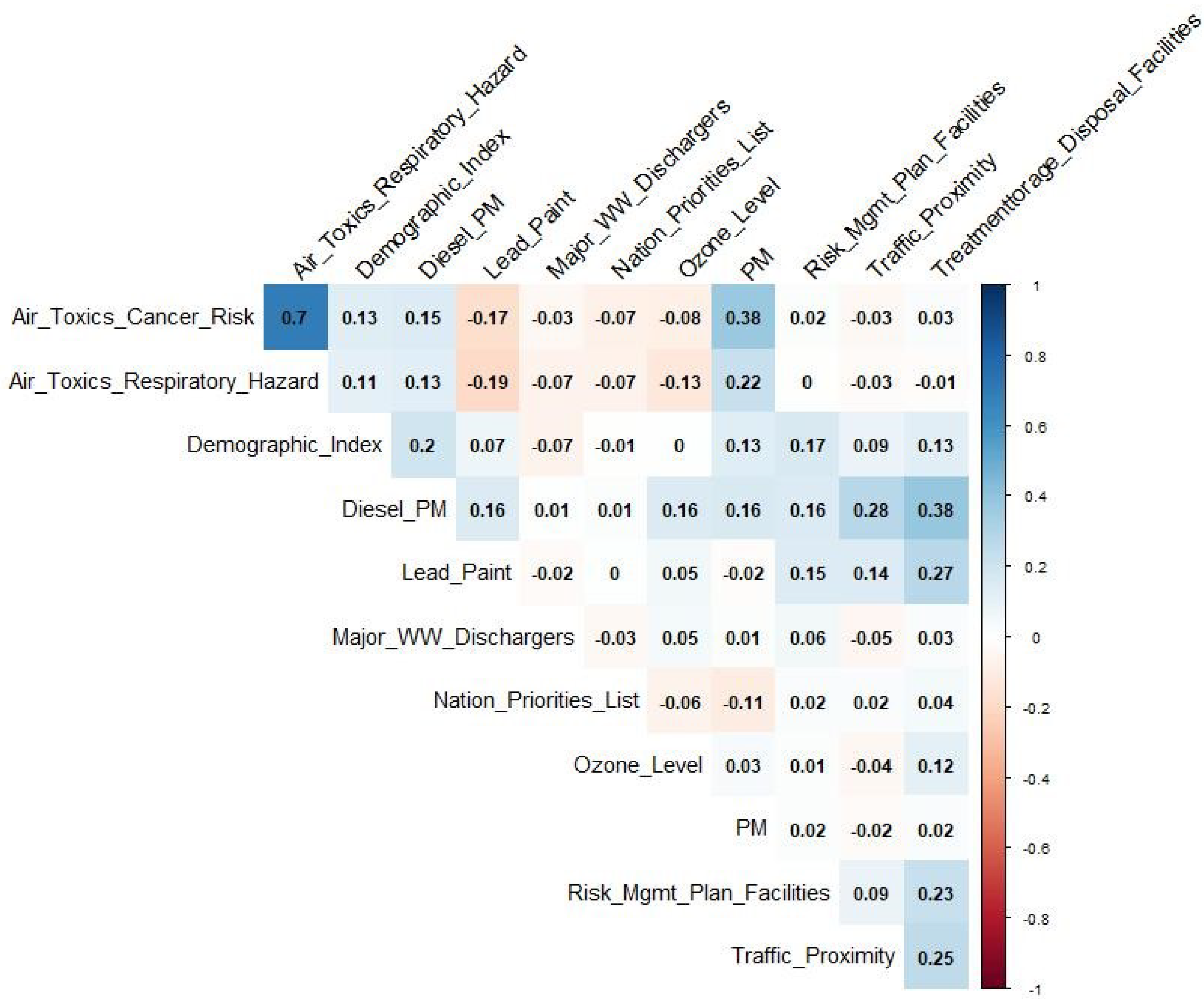


Figure B-38. National Percentile Socioeconomic Indicators Box Plot Using A 50-mile Radius

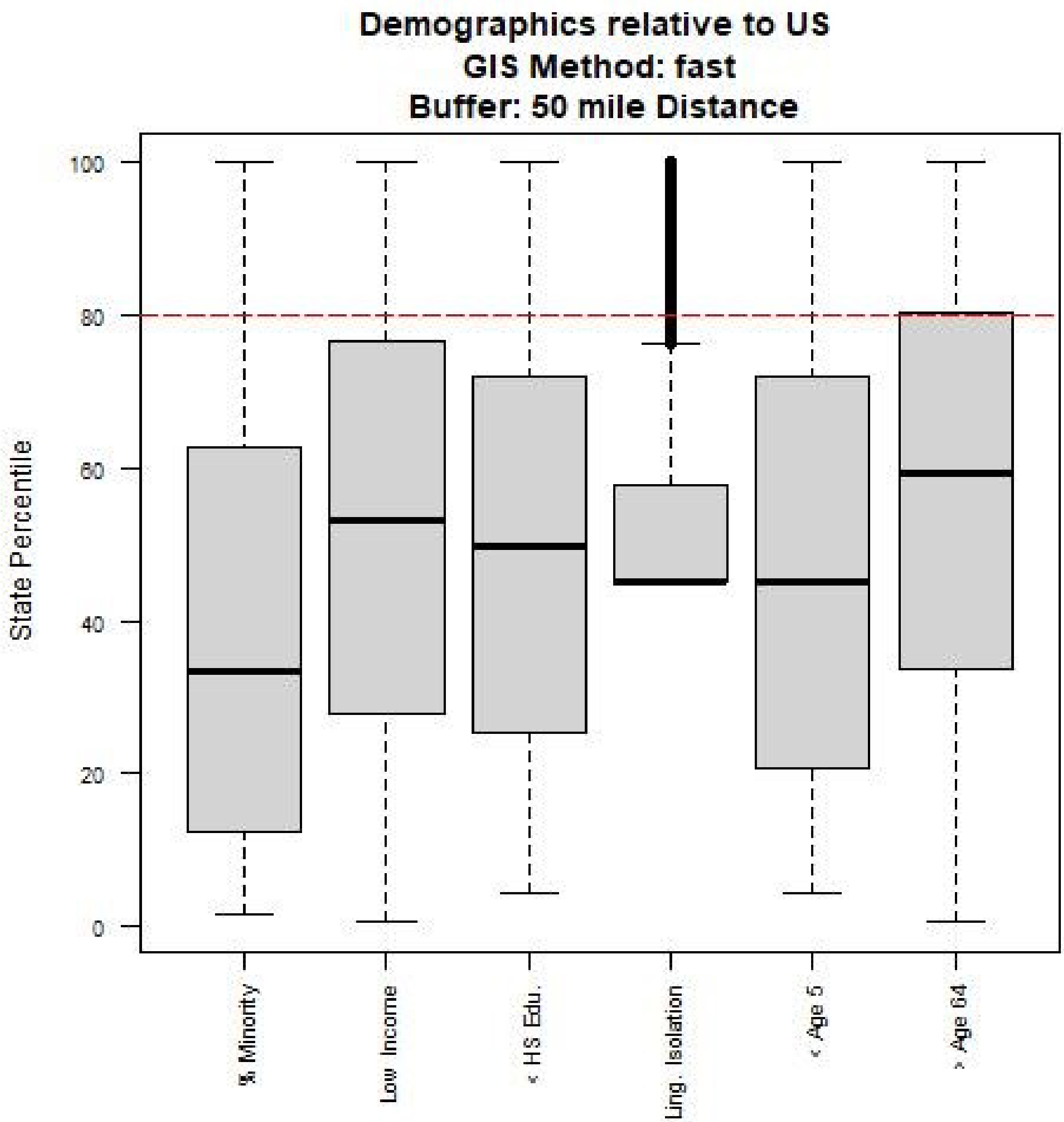


Figure B-39. National Percentile Environmental Indicators Box Plot Using A 50-mile Radius

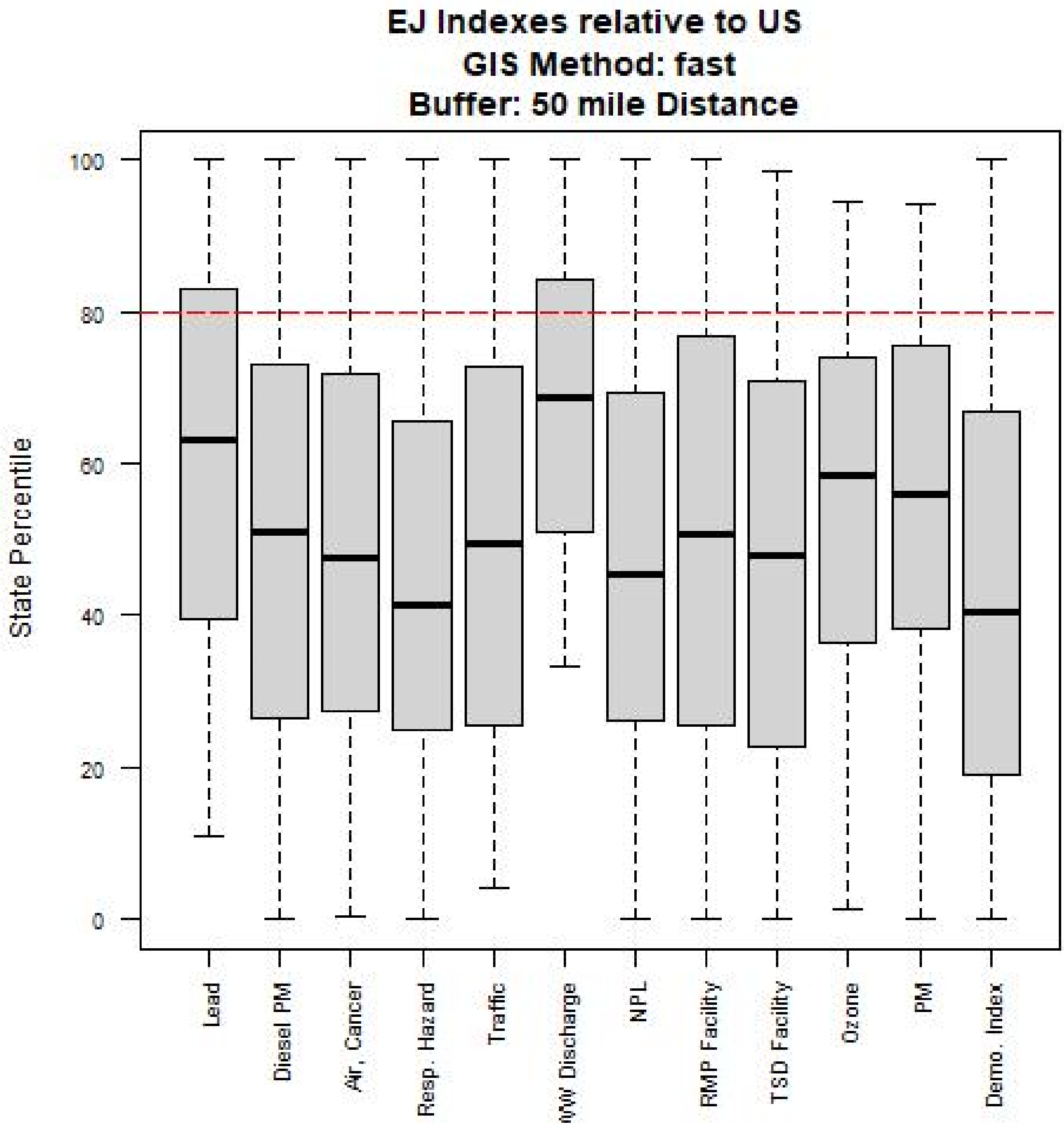


Figure B-40. State Percentile Socioeconomic Indicators Correlation Plot Using A 100-mile Radius

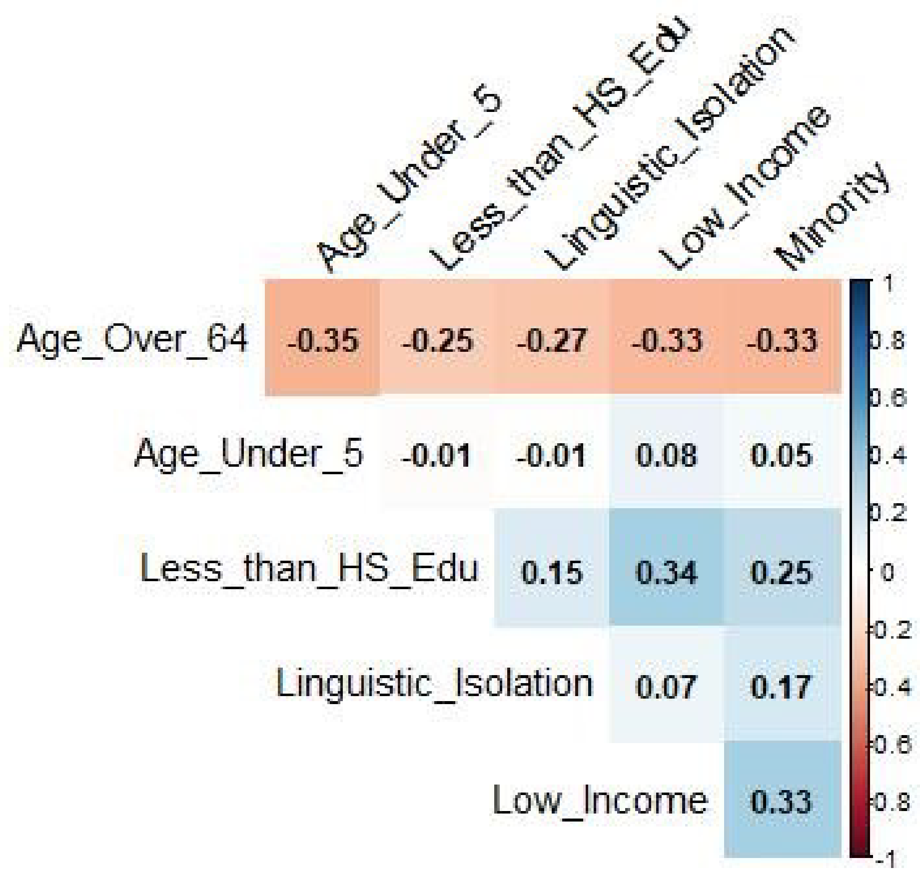


Figure B-41. State Percentile Socioeconomic Environmental Correlation Plot Using A 100-mile Radius

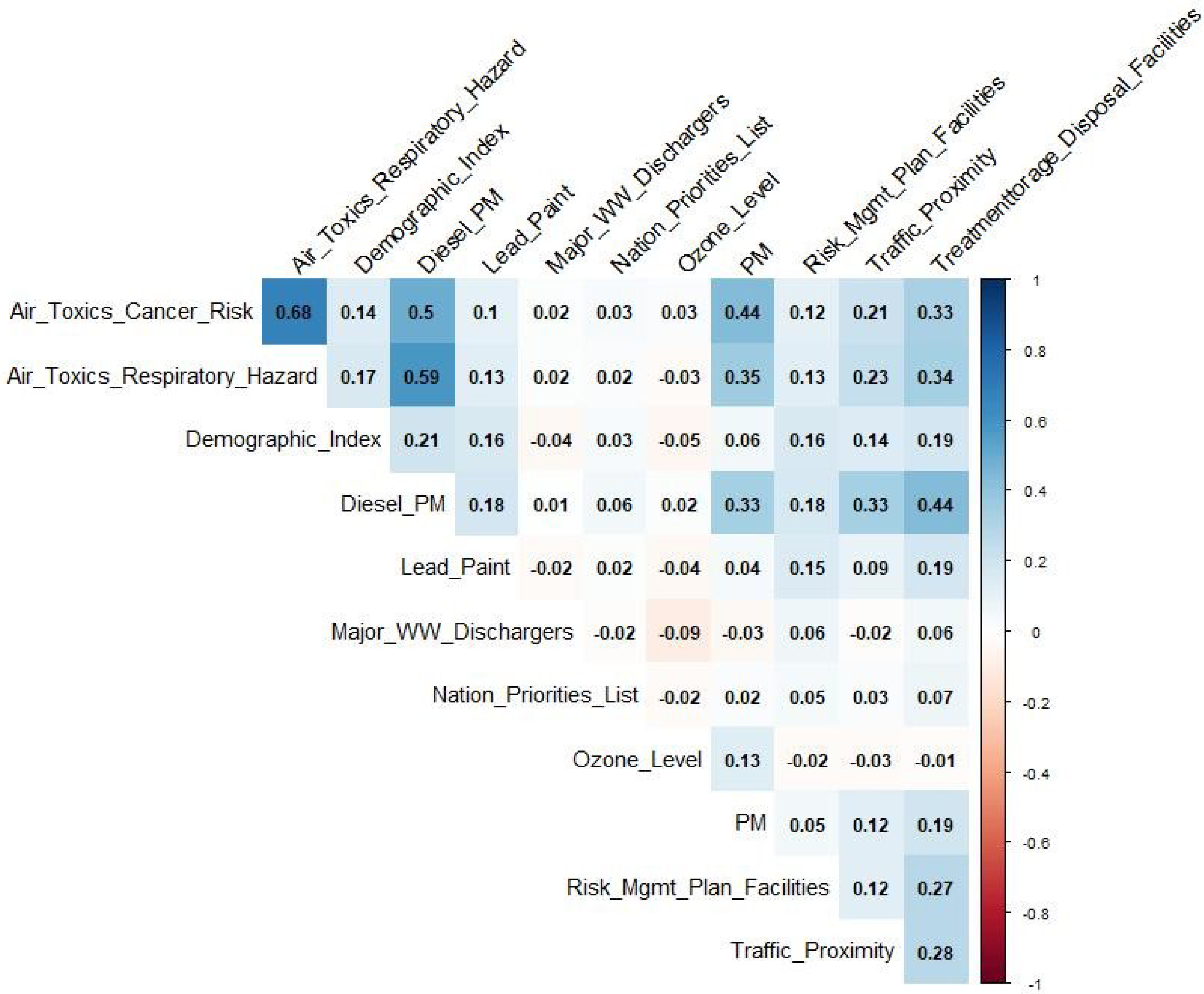


Figure B-42. State Percentile Socioeconomic Indicators Box Plot Using A 100-mile Radius

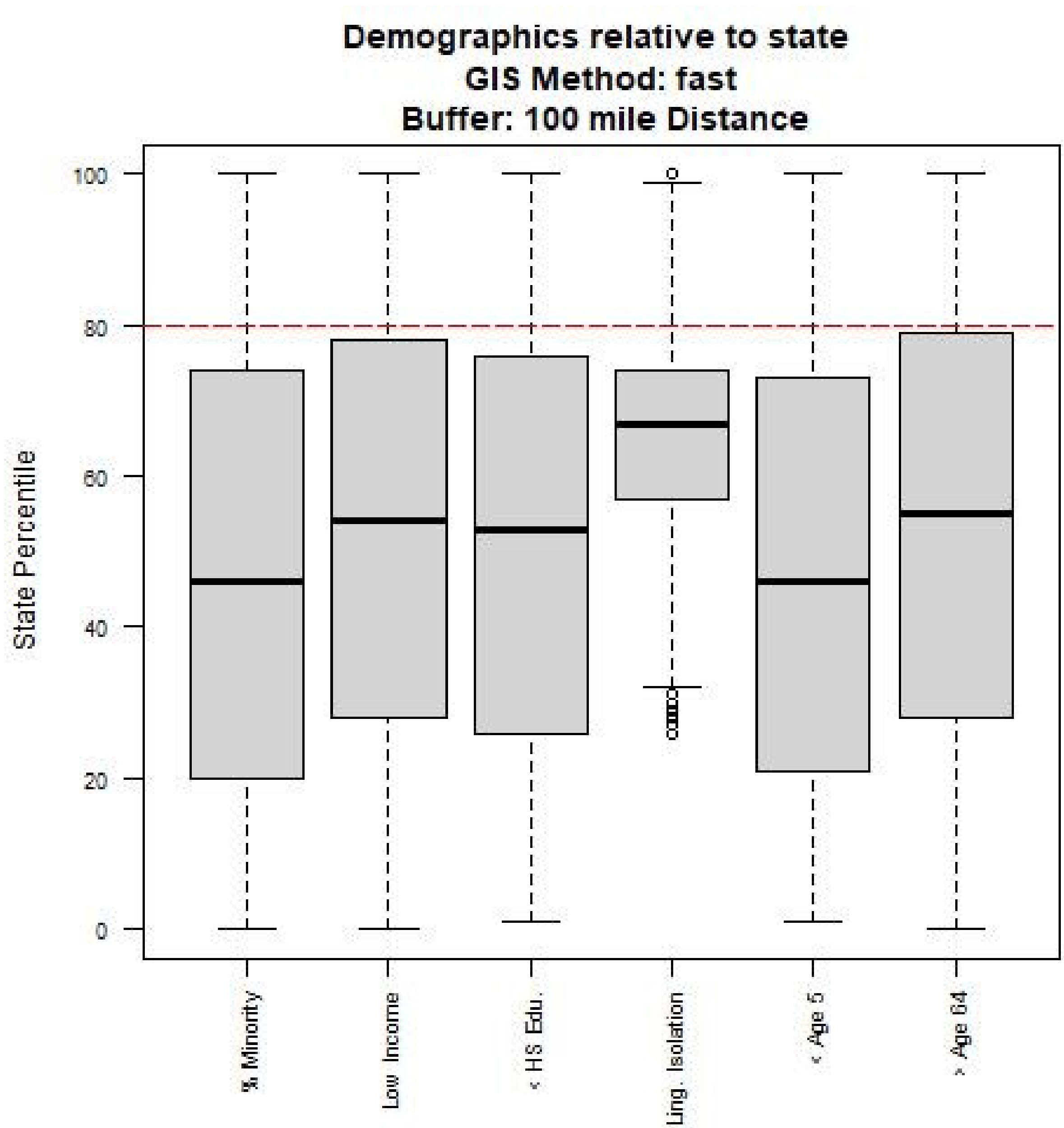


Figure B-43. State Percentile Environmental Indicators Box Plot Using A 100-mile Radius

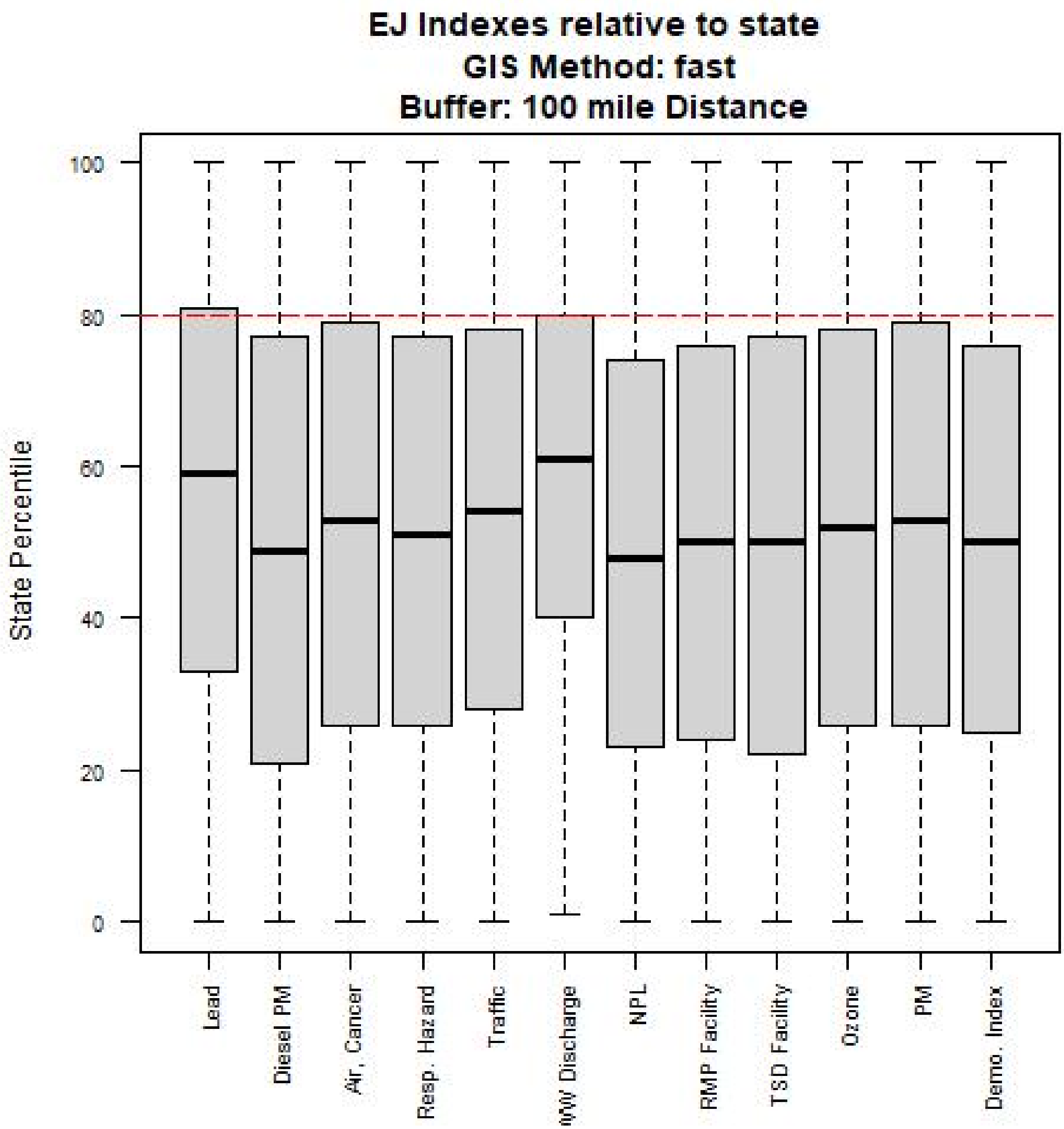


Figure B-44. National Percentile Socioeconomic Indicators Correlation Plot Using A 100-mile Radius

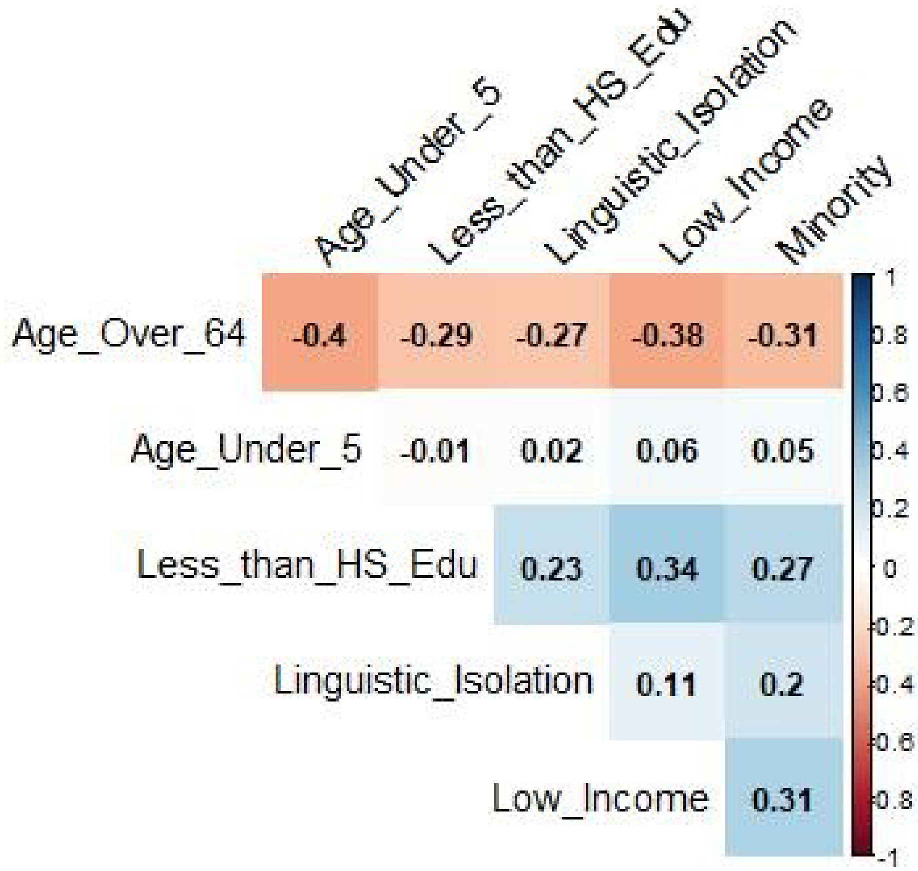


Figure B-45. National Percentile Environmental Indicators Correlation Plot Using A 100-mile Radius

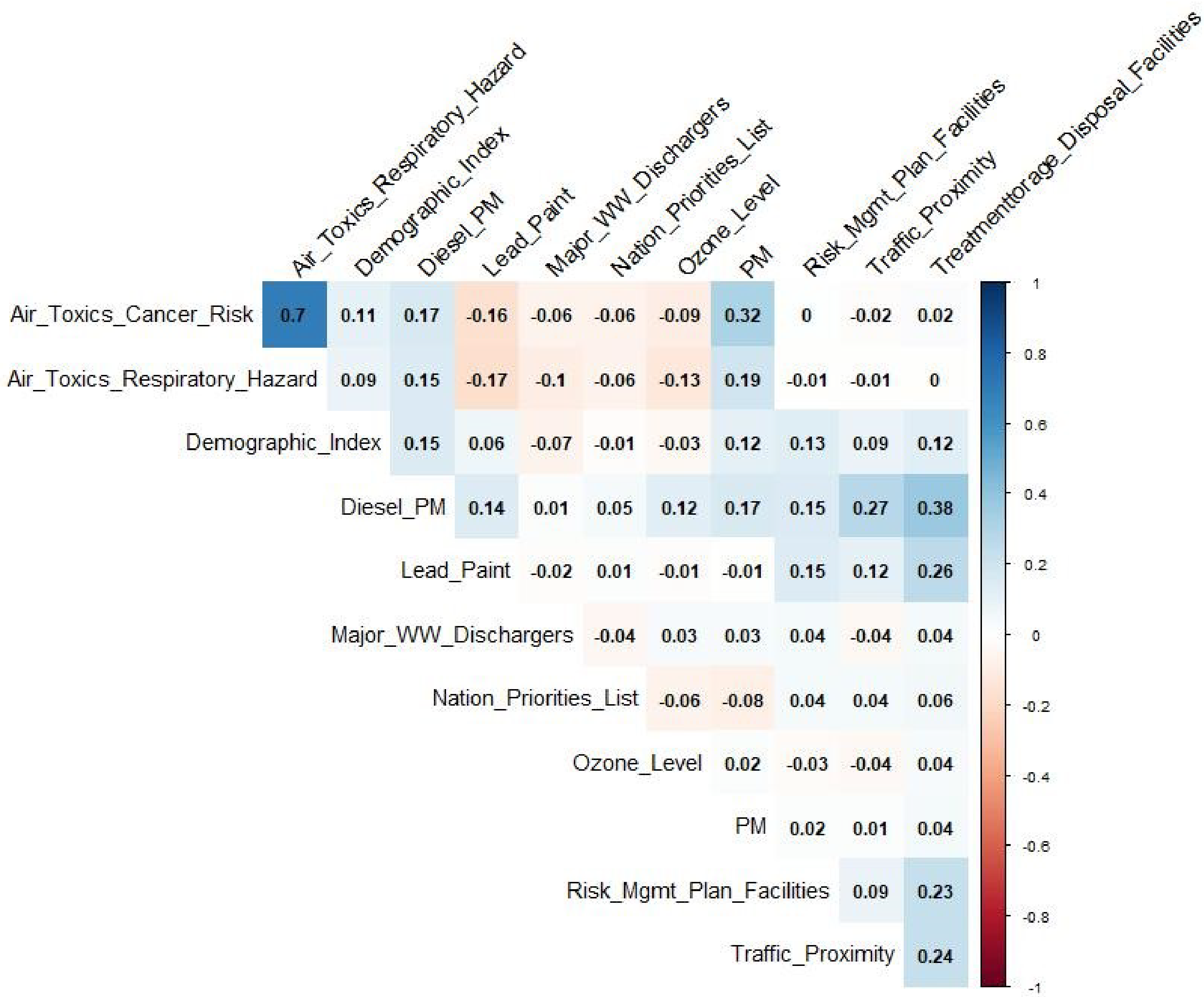


Figure B-46. National Percentile Socioeconomic Indicators Box Plot Using A 100-mile Radius

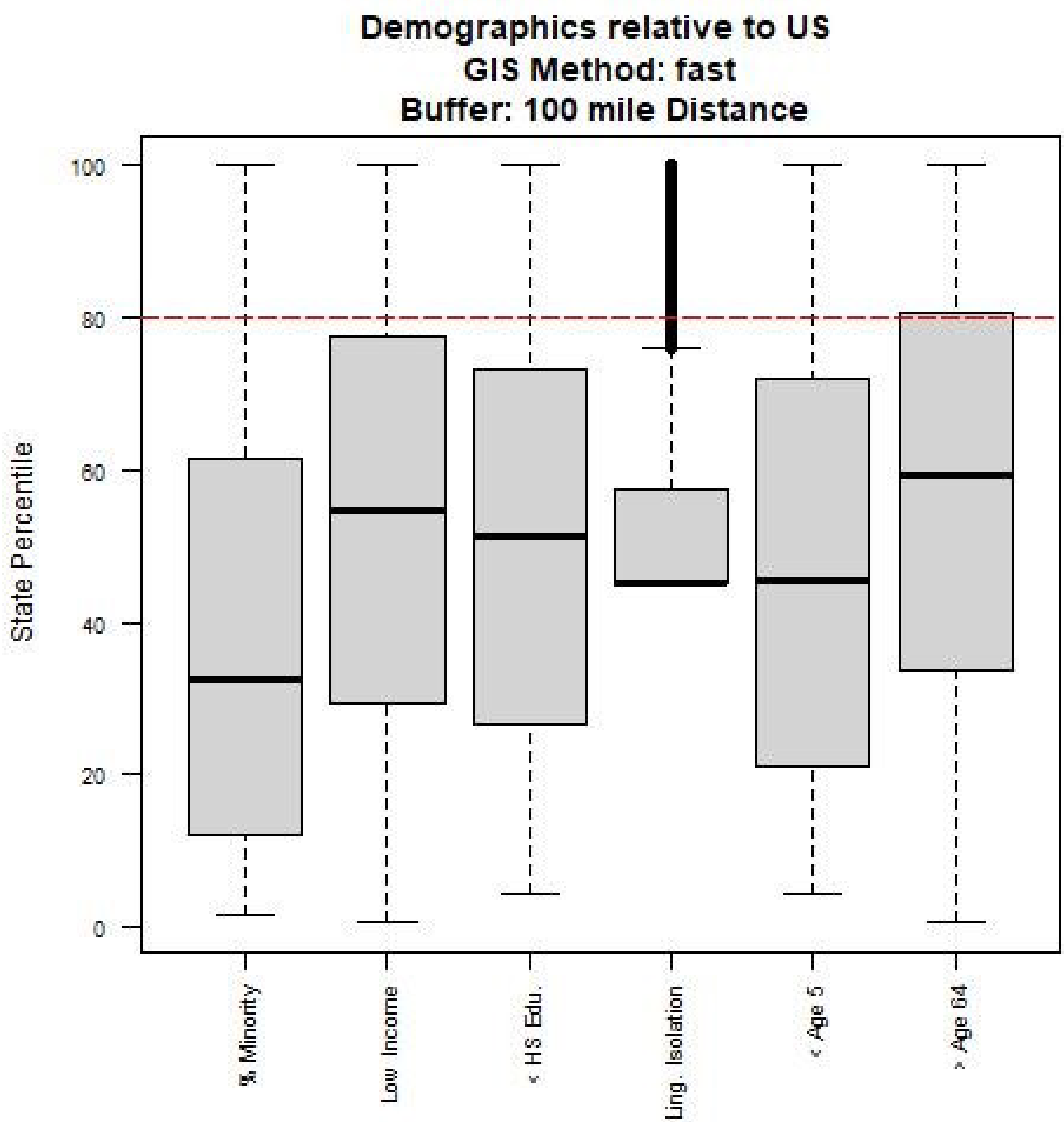
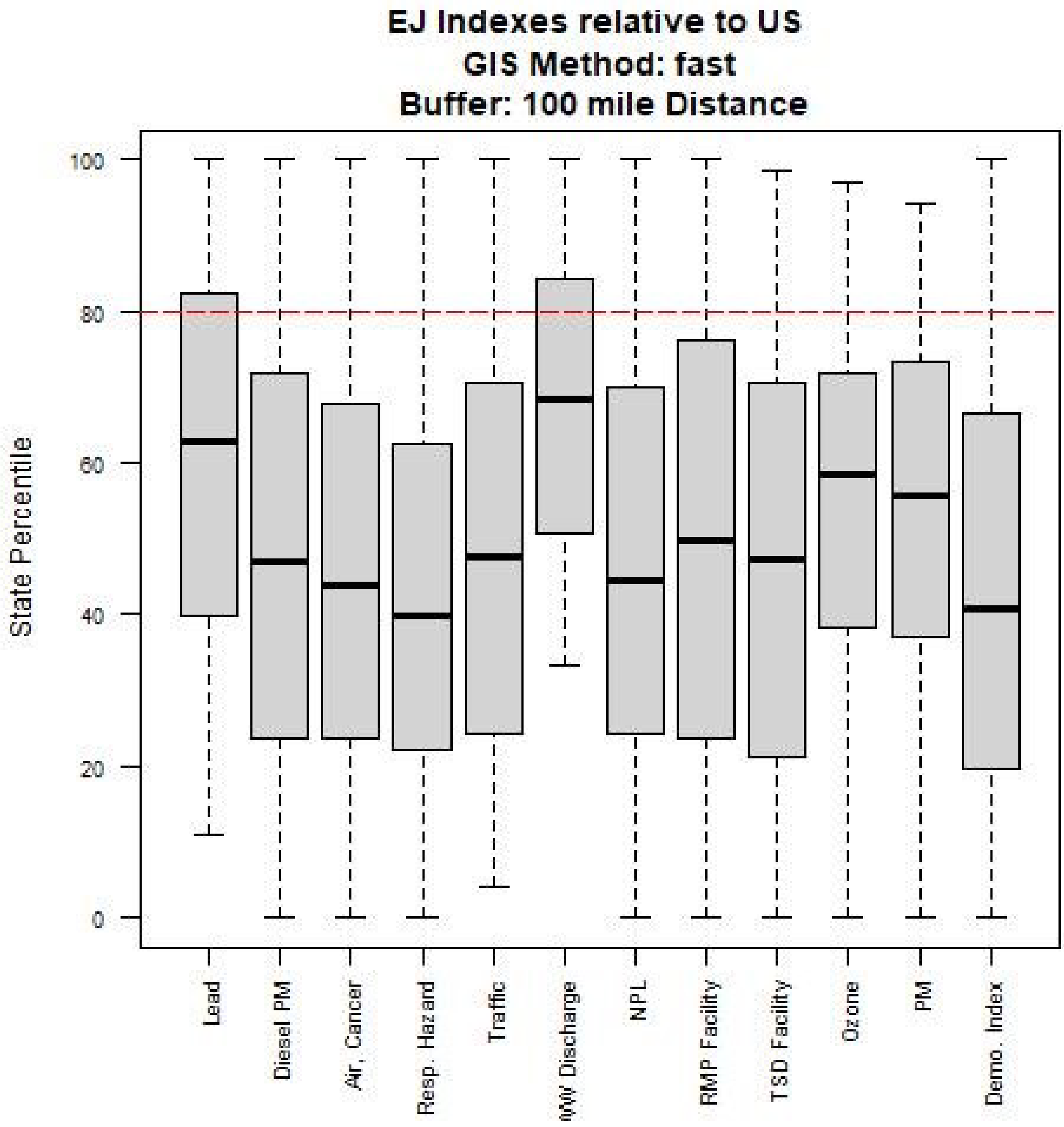


Figure B-47. National Percentile Environmental Indicators Box Plot Using A 100-mile Radius



Section 3: Results from the Drinking Water Screening Analysis

Figure B-48. State Percentile Socioeconomic Indicators Correlation Plot Using A 0.01-mile Radius

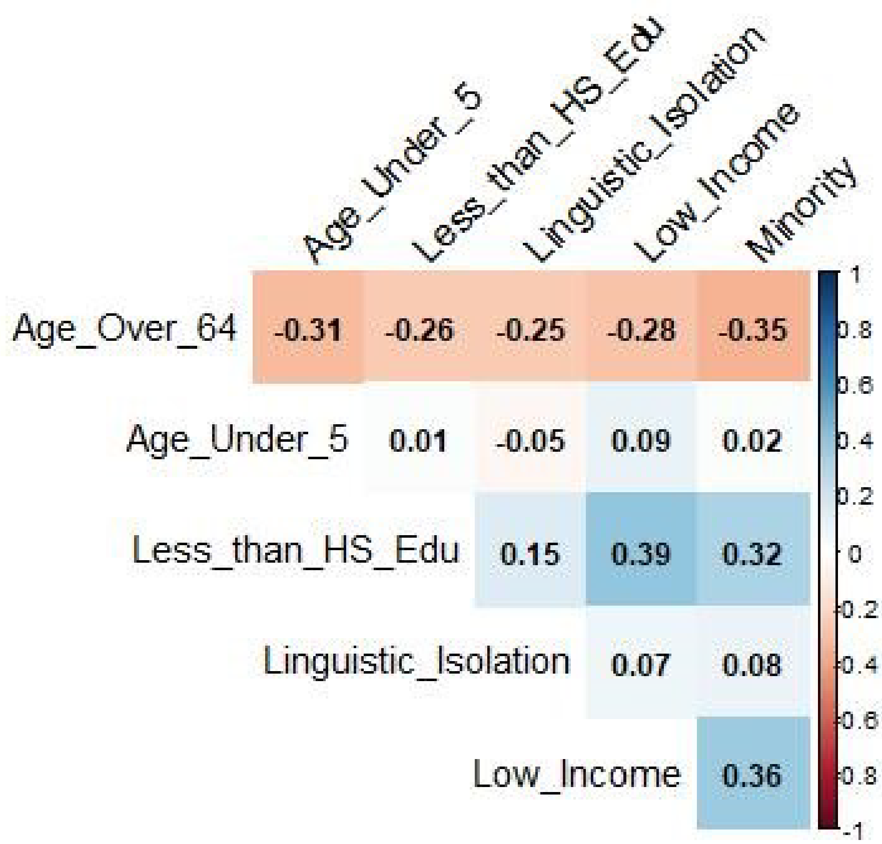


Figure B-49. State Percentile Environmental Indicators Correlation Plot Using A 0.01-mile Radius

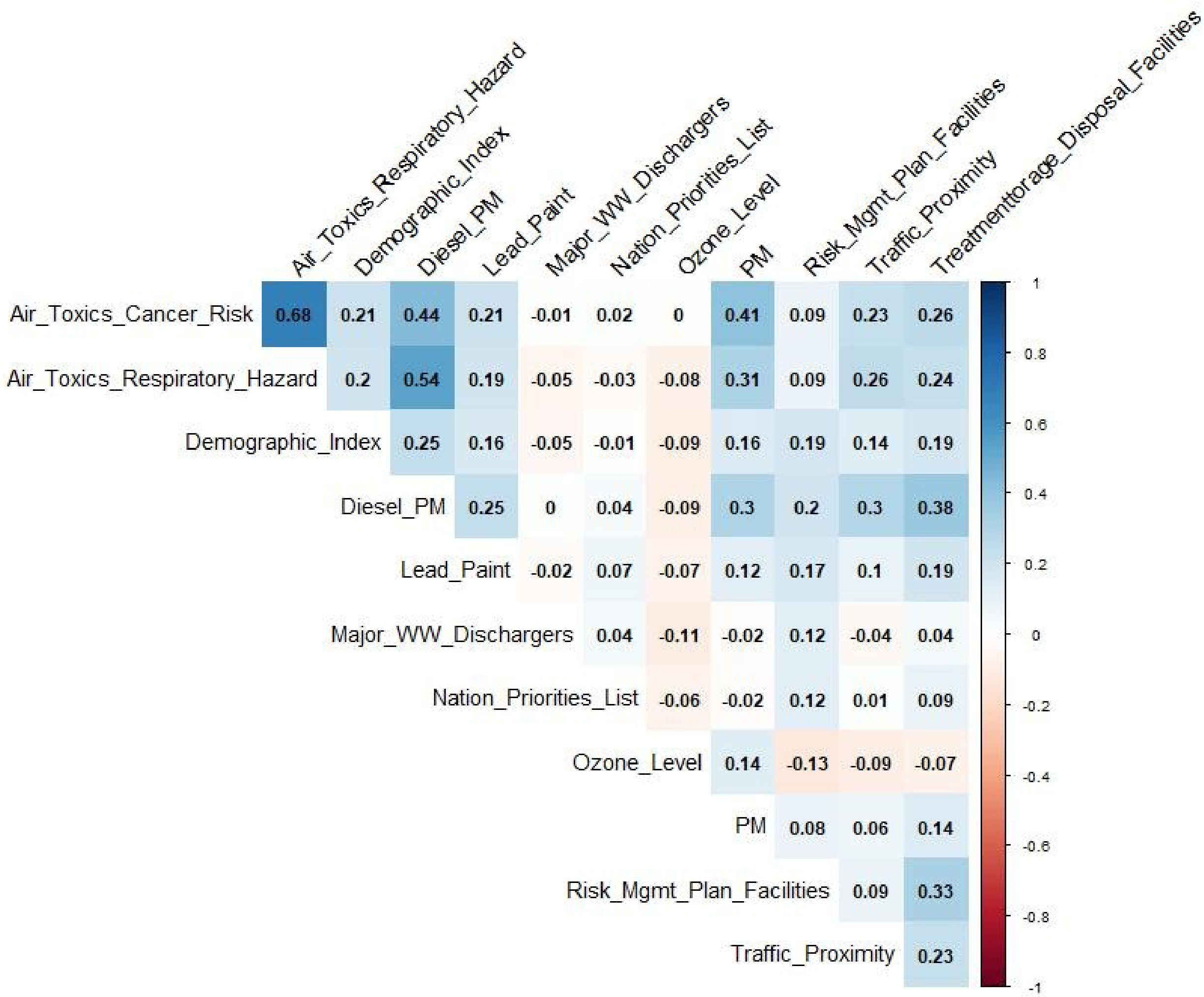


Figure B-50. State Percentile Socioeconomic Indicators Box Plot Using A 0.01-mile Radius

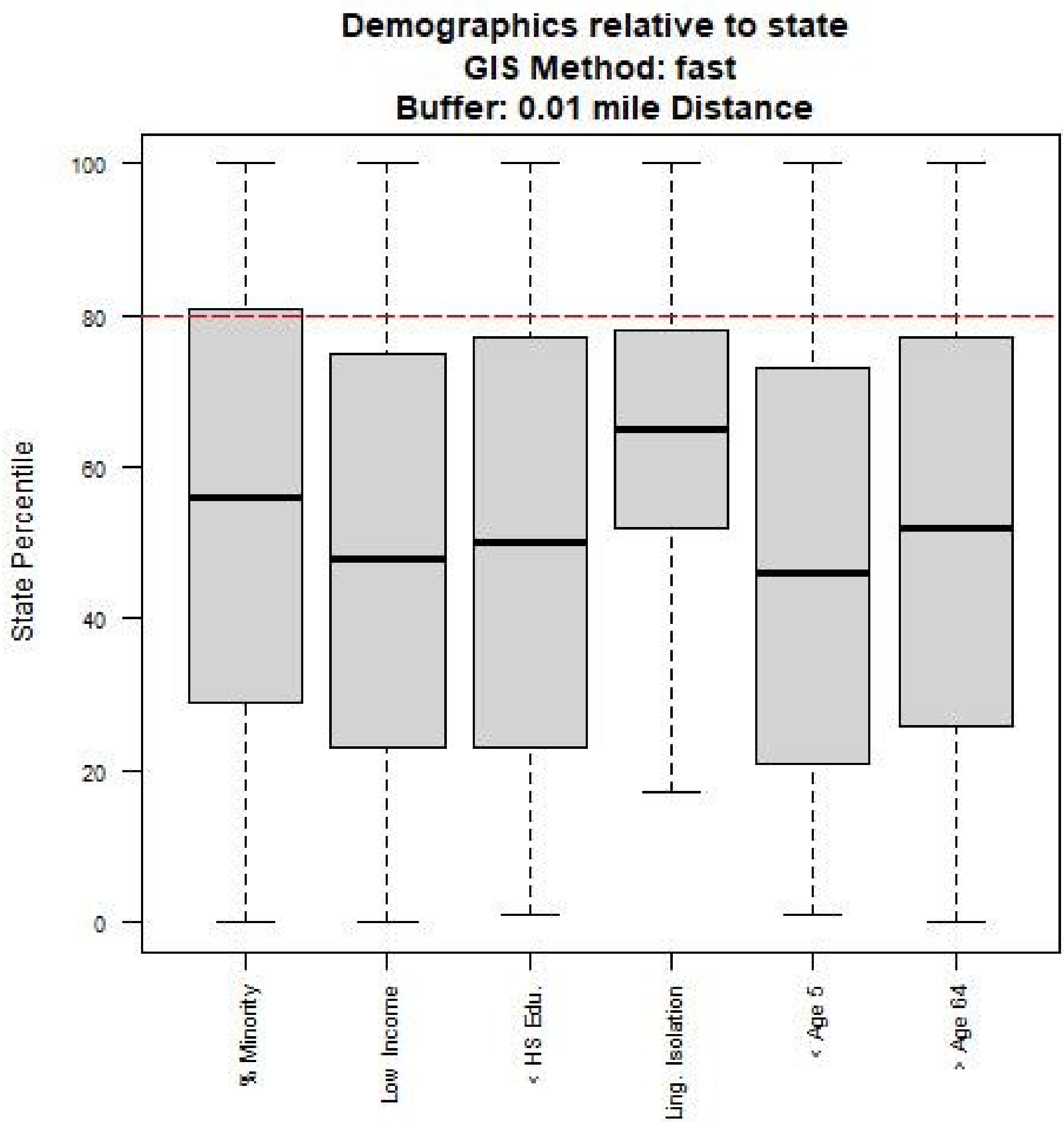


Figure B-51. State Percentile Environmental Indicators Box Plot Using A 0.01-mile Radius

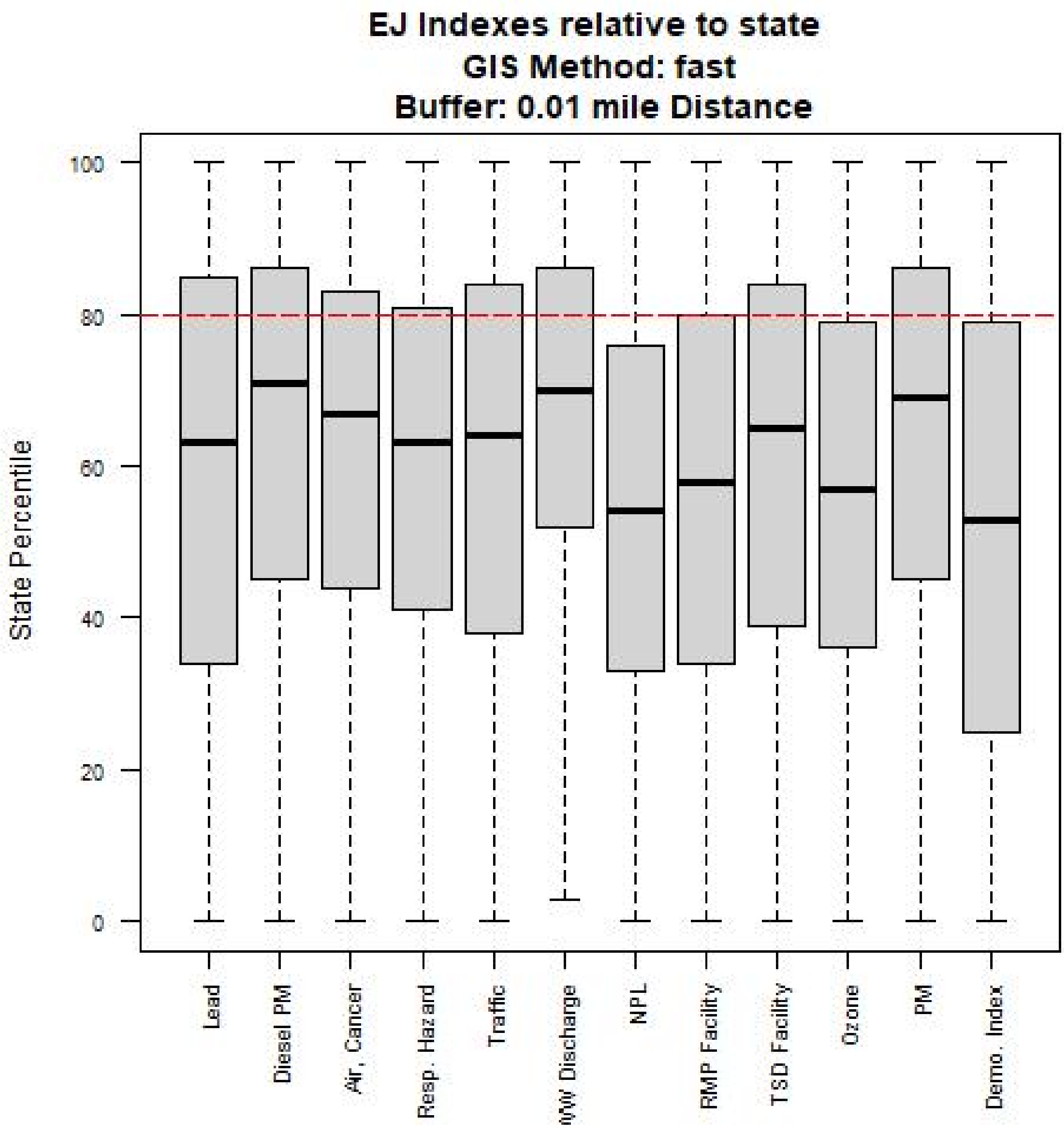


Figure B-52. National Percentile Socioeconomic Indicators Correlation Plot Using A 0.01-mile Radius

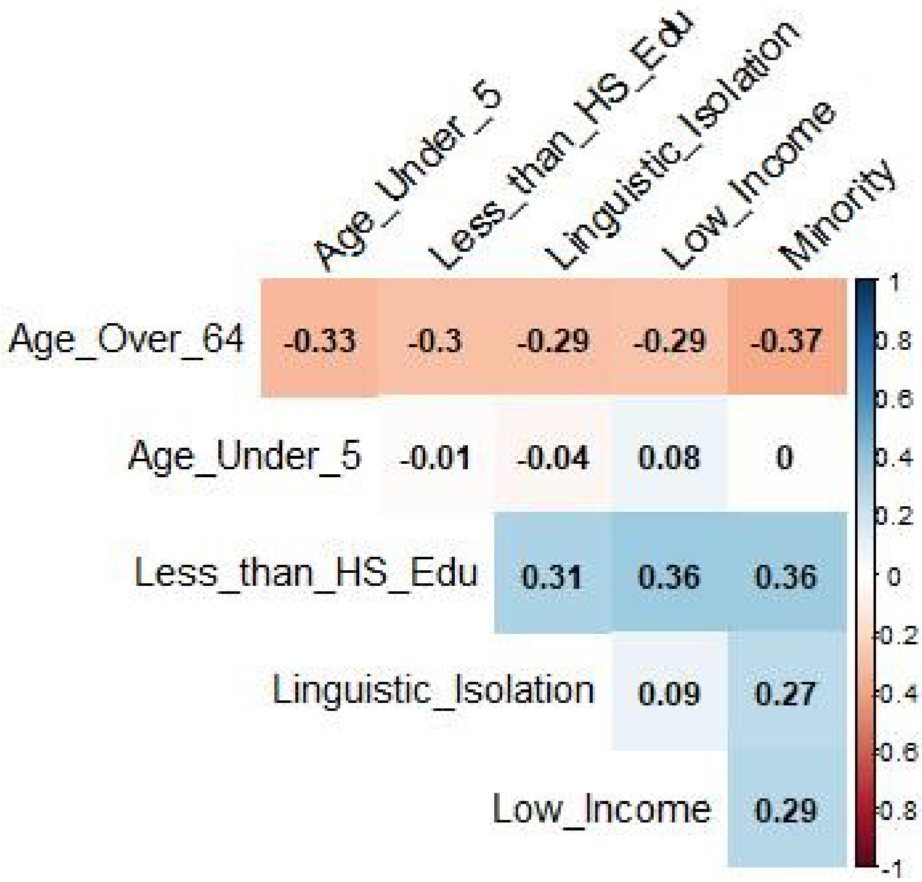


Figure B-53. National Percentile Environmental Indicators Correlation Plot Using A 0.01-mile Radius

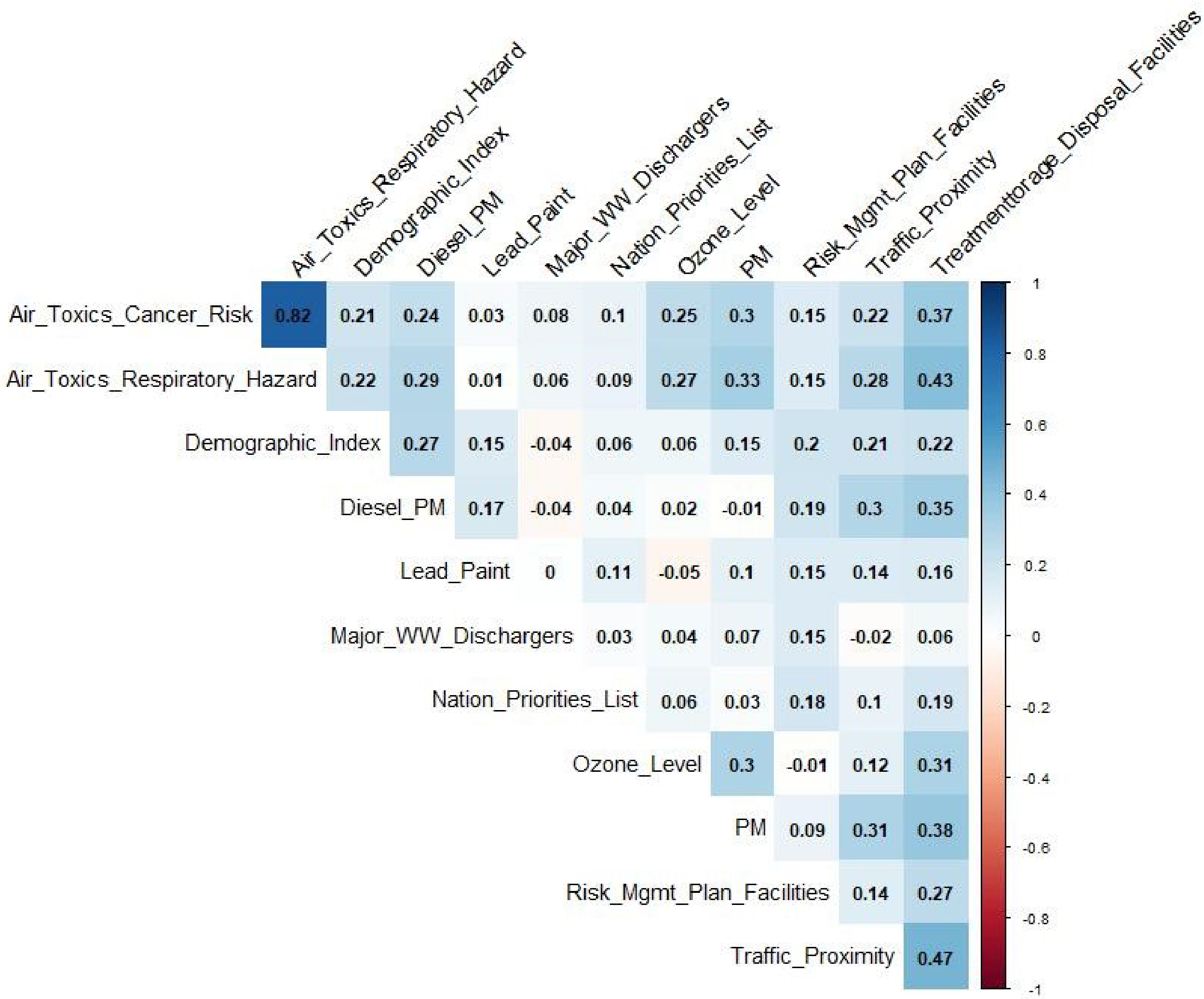


Figure B-54. National Percentile Socioeconomic Indicators Box Plot Using A 0.01-mile Radius

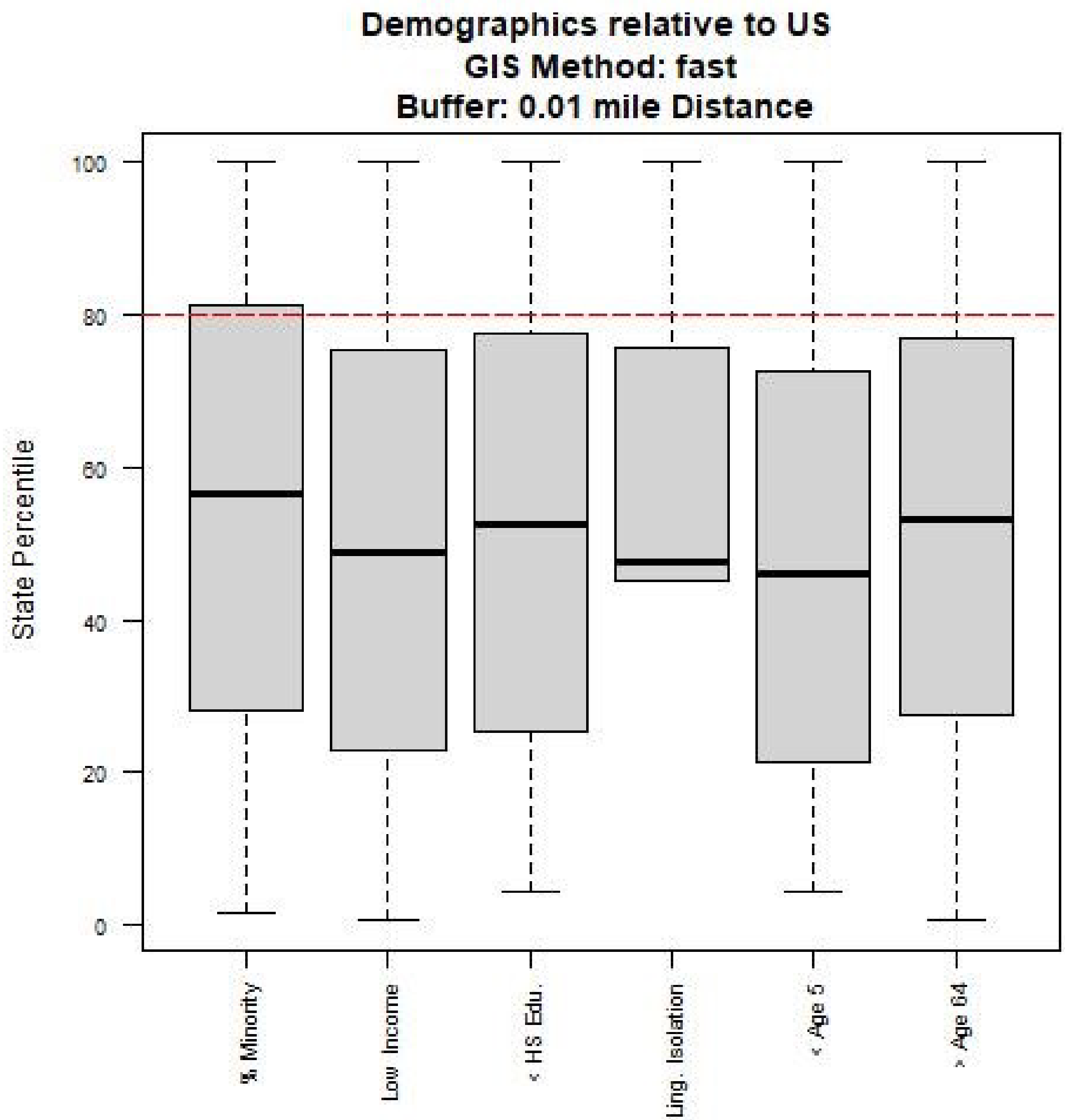
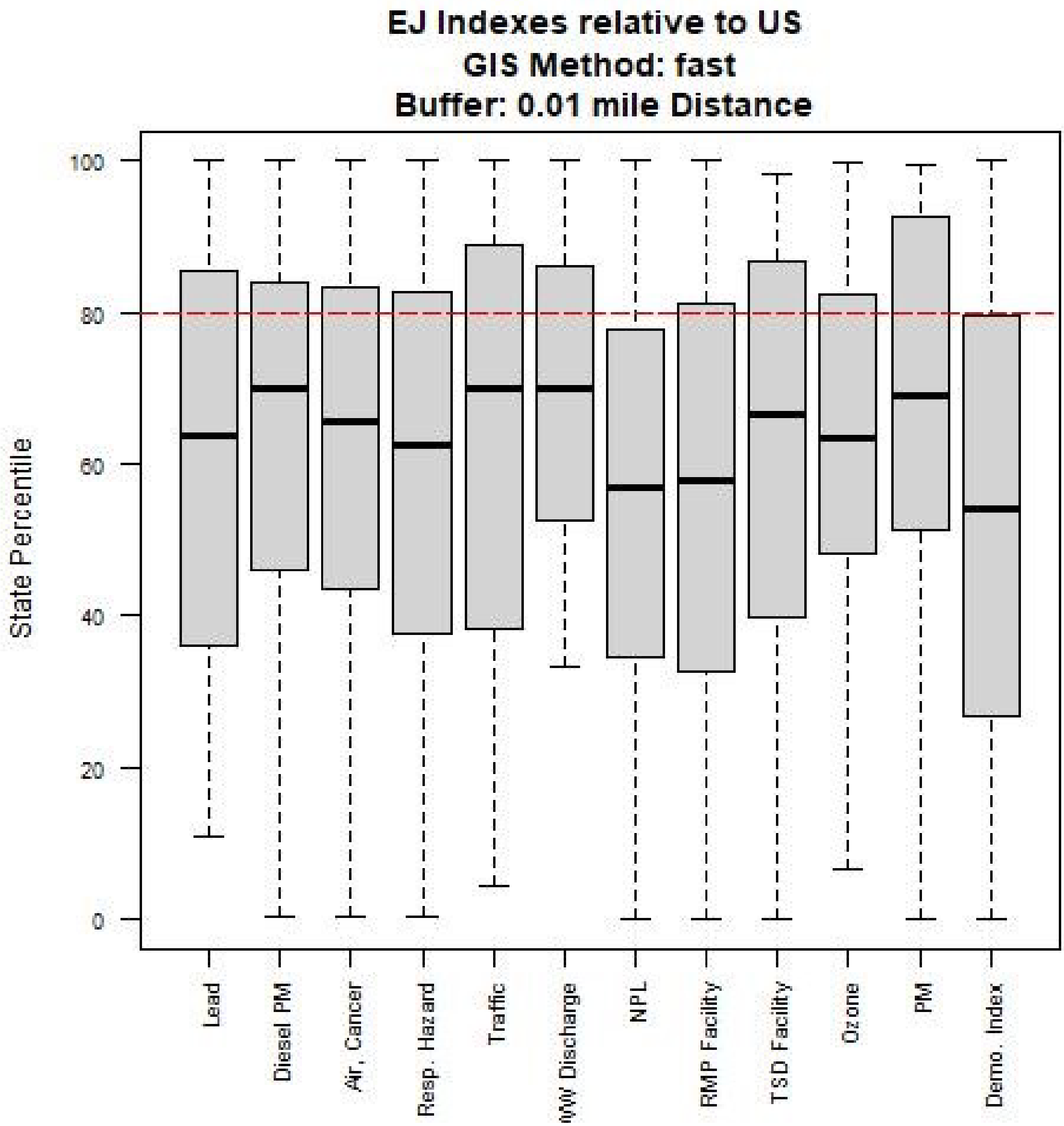


Figure B-55. National Percentile Environmental Indicators Box Plot Using A 0.01-mile Radius



Appendix C: Public Outreach and Meeting Materials

This section of the appendix presents the materials that EPA developed for its initial public outreach and meetings the Agency conducted and held with a subset of communities expected to be affected by the proposed rule that were identified by the Agency as having PEJC.

United States Environmental Protection Agency

Office of Water
April 2022

Join Listening Sessions to Shape the Steam Electric Rule

The U.S. Environmental Protection Agency (EPA) is a federal government agency whose mission is to protect human and environmental health. EPA can do this through laws that limit pollution from industrial sources into the environment.

Introduction

EPA's Effluent Limitations Guidelines (ELG) program sets national laws (regulations) to limit pollution into surface waters—like lakes, rivers, and streams—from industrial sources (Figure 1).

Figure 1: Examples of Industrial Sources Regulated by ELGs


Meat & Poultry Processing

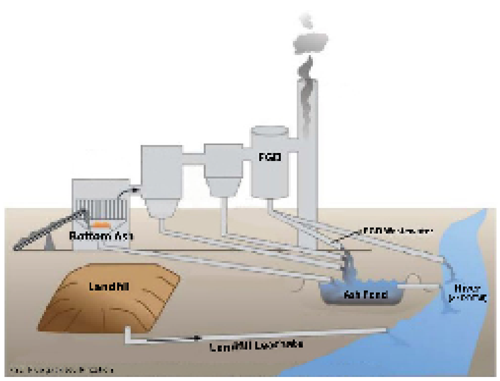

Oil & Gas Extraction


Electricity Generation


Pesticide & Chemical Manufacturing

In August 2021, EPA announced that it will be developing limits on polluted water released by power plants using coal (Figure 2). Power plants must clean any polluted water before it flows into nearby lakes, rivers, and streams.

Figure 2: Diagram of Polluted Water Created by Coal-fired Power Plants



Why Your Community's Input Matters

EPA is conducting an environmental justice (EJ) analysis to look at the pollution exposure for potentially affected communities. EPA would like to meet with community members to talk about the following topics:

1. Ideas and strategies for limiting pollution from power plants.
2. Concerns from community members related to power plants or other sources of pollution; nearby rivers, lakes, and streams; or their drinking water.
3. Community health, social or economic concerns.

How your Input Will be Used by EPA

EPA will consider community input as it develops the requirements for power plants. EPA will complete calculations (analysis) on pollution exposures and health effects across potentially affected communities.

EPA will post information for communities to its Supplemental Steam Electric Rule website (https://www.epa.gov/eg/2021-supplemental-steam-electric-rulemaking) including:

- How EPA used the community input.
- The findings of the analysis.
- Next steps in the regulation process.
- Opportunities for communities to continue engagement with EPA.

Contact Information

Questions and Comments are Welcome!

If you have questions or comments on the Supplemental Steam Electric Rule, please contact:

Richard Benware
Email: benware.richard@epa.gov
Phone: 202.566.1369

If you have questions or comments on the EJ Analysis, please contact:

Julia Monsarrat
Email: monsarrat.julia@epa.gov
Phone: 202.566.2887

Figure C-1. Community Outreach Factsheet

Figure C-2. Community Meeting Presentation

Zoom Meeting Housekeeping

- Audio is available through your computer's mic and speakers or by telephone.
- Type questions into the Chat box in the bottom dashboard.
- To raise your hand, click the "Reactions" icon, in your dashboard, then click "Raise Hand."
- Please feel free to ask questions throughout the presentation.
- Please contact Morgan.Collins@erg.com if you are having technical issues with Zoom.

1

Why are we here? (Introduction)

- The U.S. Environmental Protection Agency (EPA) is a federal government agency whose mission is to protect human and environmental health.
- EPA can do this through laws that limit pollution from industrial sources into the environment.
- This meeting is intended to discuss water pollution, specifically from local power plants.

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What is the Effluent Limitations Guidelines Program?

Effluent Limitations Guidelines (ELG) sets national laws (regulations) to limit pollution into surface waters–like lakes, rivers, and streams–from industrial sources.

Steam Electric ELG sets standards for cleaning polluted water from power plants that use coal to produce electricity.

Supplemental Steam Electric Rule

Examples of industrial sources regulated by ELGs include:

Meat & Poultry Processing

Oil & Gas Extraction

Electricity Generation

Pesticide & Chemical Manufacturing

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Office of Water

What is the Supplemental Steam Electric Rule?

- In August 2021, the EPA announced that it will be developing limits on polluted water released by coal-fired power plants.
- Previously, EPA updated limits for coal-fired power plants in 2015 and 2020.
- Power plants must clean any polluted water before it flows into nearby lakes, rivers, and streams.
- The EPA can require plants to treat polluted water before they discharge it or prevent them from discharging the water at all.

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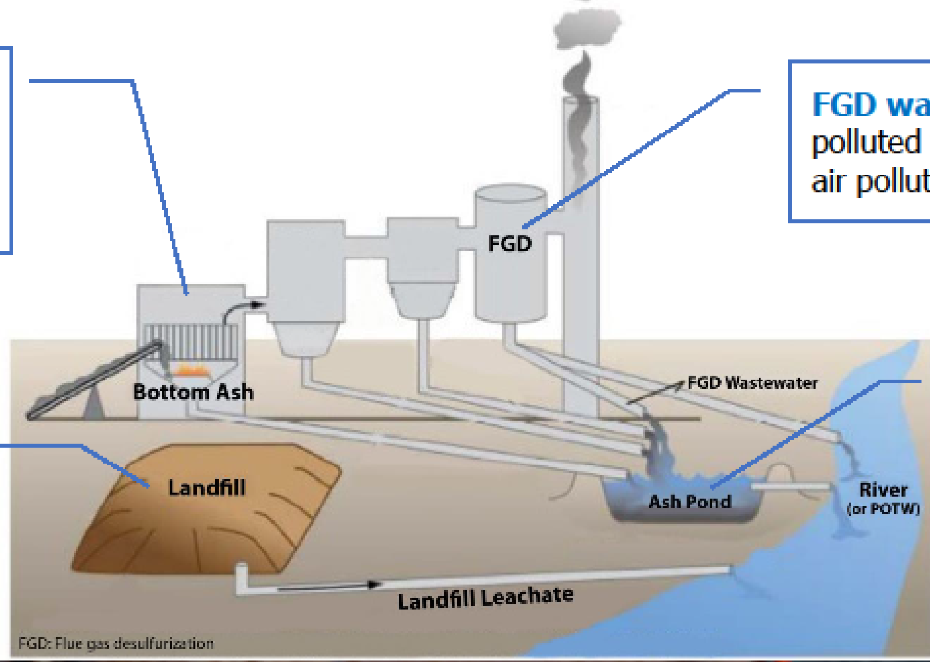
Office of Water

What are the types of polluted water?

The Supplemental Steam Electric Rule will update standards for different types of polluted water released by coal-fired power plants:

Bottom ash transport and purge water: polluted water containing ash from burning coal

FGD wastewater: polluted water from wet air pollution treatment



Landfill leachate: polluted water from ash ponds and landfills

Legacy wastewater: polluted water created and stored in ash ponds before the Supplemental Steam Electric Rule goes into effect

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Why does your community's input matter?

EPA is conducting an environmental justice (EJ) analysis to look at the pollution exposure for potentially affected communities. EPA would like to meet with community members to talk about the following topics:

1. Ideas and strategies for limiting pollution from power plants.
2. Concerns from community members related to power plants or other sources of pollution; nearby rivers, lakes, and streams; or their drinking water.
3. Community health, social or economic concerns.

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How will your input be used by EPA?

EPA will consider community input as it develops the requirements for power plants. EPA will complete calculations (analysis) on pollution exposures and health effects across potentially affected communities.

EPA will post information for communities to its Supplemental Steam Electric Rule website (https://www.epa.gov/eg/2021-supplemental-steam-electric-rulemaking) including:

- How EPA used the community input.
- The findings of the analysis.
- Next steps in the regulation process.
- Opportunities for communities to continue engagement with EPA.

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Discussion

United States Environmental Protection Agency

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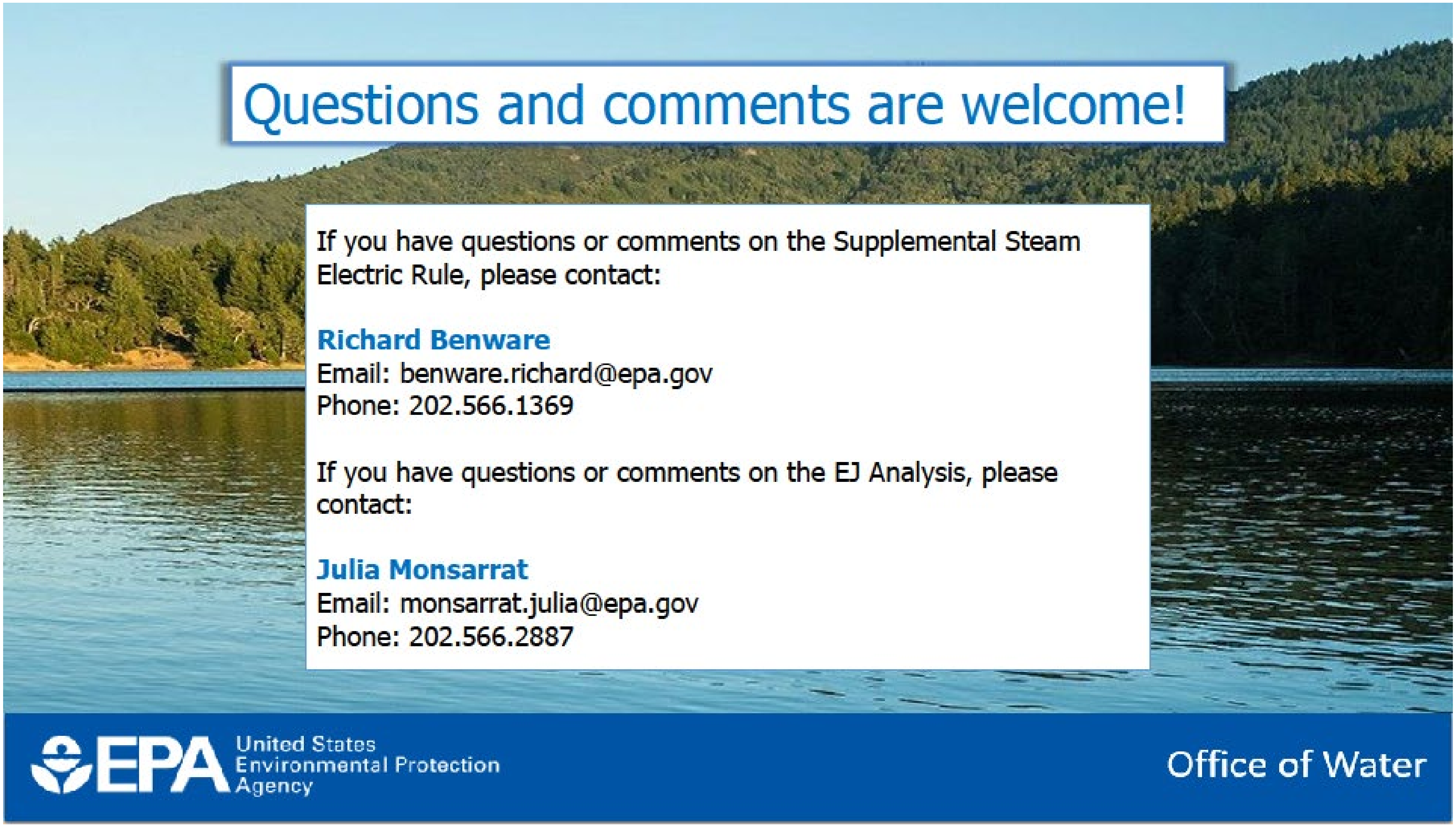
Questions and comments are welcome!
If you have questions or comments on the Supplemental Steam Electric Rule, please contact:
Richard Benware
Email: benware.richard@epa.gov
Phone: 202.566.1369
If you have questions or comments on the EJ Analysis, please contact:
Julia Monsarrat
Email: monsarrat.julia@epa.gov
Phone: 202.566.2887
United States Environmental Protection Agency
Office of Water

Appendix

United States Environmental Protection Agency

Office of Water

EPA's Statutory Authority

- Under the authority of the Clean Water Act (CWA), EPA establishes regulations that apply to categories of industrial wastewater dischargers.
  - These regulations are known as ELGs.
- The CWA section 304(b) requires EPA to annually review and, if appropriate, revise ELGs. Every other year, EPA publishes a plan for new and revised ELGs, after public review and comment.
- The Steam Electric Power Generating sector is considered a regulated industry.

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Technology-Based Effluent Limitations

- Technology-based effluent limitations (TBELs) require a minimum level of treatment of pollutants for point source dischargers based on available treatment technologies.
- The discharger can use any available technology to meet the limits.
- The Supplemental Steam Electric Rule is based on TBELs.
  - One example of a potential TBEL is chemical precipitation technology used to treat FGD wastewater. This is a tank-based system designed primarily to remove suspended solids.

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Water Quality-Based Effluent Limitations

- In some cases, TBELs alone will not achieve the applicable water quality standard.
- The CWA allows development of water quality-based effluent limitations (WQBELs) to ensure that the water body can meet its water quality goals with the proposed discharge.
- Permit writers develop WQBELs based on site-specific factors. They can also be derived from Total Maximum Daily Loads (TMDLs).

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Appendix D: Public Meeting Notes

This section of the appendix provides detailed summaries of the public meetings that EPA held with a subset of communities expected to be affected by the proposed rule that were identified by the Agency as having PEJC.

Exhibit A. Navajo Nation Community Meeting in Support of the Proposed Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category

May 11, 2022

Format: Virtual

Presenters:

- Richard Benware: EPA Office of Water (OW)
- Julia Monsarrat: EPA OW ORISE Fellow

Comments Regarding the Effluent Limitations Guidelines and Standards (ELG) Rulemaking

- There is overlap between ELGs for coal ash wastewater discharges (under the Clean Water Act) and the coal ash landfill and impoundment rule under the Resource Conservation and Recovery Act (RCRA). In addition to bottom ash transport water regulated by the current ELGs, participants noted there is also legacy coal ash discharges seeping out of existing impoundments into Chaco Creek.
    - EPA OW is coordinating with EPA Office of Land and Emergency Management (OLEM) regarding the Coal Combustion and Residuals (CCR) Rule and representatives attending this meeting can communicate any relevant information to colleagues in EPA's Office of Land and Emergency Management (OLEM).
- Community participants support stricter (and the most stringent) ELGs and faster timeframes for compliance. In addition, remediation of contaminated sites should have faster timelines.
- The Steam Electric ELGs should impose regulations that eliminate discharges and regulate all pollutants in these discharges. The rule should protect groundwater and all groundwaters that flow into surface waters.
- Community members would like to eliminate the discharge of bottom ash water.
- EPA needs to protect Navajo Nation's scarce water resources.
- There is a limit to tribal consultation and consent. The process of government-to-government communication is not fully transparent or communicated to community members who have encountered issues across the community.

Environmental, Human Health, and Other Community Concerns

- There are a number of environmental justice (EJ) issues in the Four Corners region that pertain to air quality, water quality, and cultural/spiritual impacts.
    - Community members expressed concern with disproportionate impacts of pollution, especially water pollution and resources, noting that these issues have not abated over the long history of industry on Navajo Nation lands.
    - The San Juan River is a cultural and spiritual river for the Diné people. It is considered a male river and a provider.
    - The Navajo Nation lacks infrastructure, including running water and electricity.

  - The Navajo Nation is currently dealing with climate-change related issues including drought and dust storms. Local power plants in the area were once the biggest polluters in the U.S., and community members noted the cumulative effects have led to the current climate crisis.
  - Lack of dependable water negatively impacts farming. Many community members are self-sufficient through gardening and farming. People travel 30 to 40 miles to get safe water for drinking or agriculture. Some people are being forced to sell their animals due to economic impacts.
  - There are very few hospitals on the reservation (eight), making it very difficult for people to travel to health centers. Community members must travel a long way to get necessities like oxygen and medication. It is also expensive to make that trip now, given high gas prices.
  - The current environmental and health problems in the Navajo Nation community are due to short-term profits of coal-fired power plants and other oil and gas industries. The jobs in the extractive industries are not worth it when health and entire communities are sacrificed in the process.
- Long-time community members noted that prior to the FCPP operation, in the 1950s and 1960s, the area included fields of flowers across the desert and dependable rainfall and snowfalls that provided the needed precipitation. Currently, the landscape is dry and barren.
  - Once power plants opened in the area, the community began to experience air pollution and visible smog, especially prior to power plants making the effort to control the release of air pollutants. Even after installing wet scrubbers and other infrastructure, community members noted that plant operators would turn off the pollution control apparatus at sundown, allowing smog to spew out overnight. This created a haze of pollution across the horizon in the morning.
  - Growing up on a farm, one community member remembered noticing how the water changed – becoming murky and polluted. Families without running water would use river water for drinking and irrigation and would boil water before drinking or using for cooking or washing.
- The Navajo Nation draws agricultural water from the San Juan River, and they do not know the extent to which the power plant is putting pollutants into the river.
- In addition, the use of water resources from coal-fired power plants are significant. About 50,000 acre-feet of water is removed from San Juan River to cool the FCPP and San Juan Generating Station. Reallocation of water resources would help bring the community back to the condition it was in before the power plants opened.
- Community members expressed particular concern regarding inadequate handling of coal ash waste at the FCPP. Since 1963, FCPP has generated coal ash and discarded it in a number of places, including abandoned mine pits in the Navajo Mine, located adjacent to FCPP and undisclosed locations around the area.
  - In a report[1], prepared by Dr. Campbell, a geologist who visited the site, FCPP generated and disposed of at least 89 million tons of CCR.

[1] https://earthjustice.org/sites/default/files/files/NGS-Expert-Report-GMA-6052017.pdf

    - There is concern regarding hazardous chemicals, such as mercury, lead, and arsenic, and other pollutants in coal ash on the ground may be getting into the waterways.
- Pollution in the Four Corners area has persisted for a long time and become heavily impacted by climate change, nudification of the landscape, and sediment transfer. Community members noted ecological dead zones near the coal-fired power plants. The legacy of pollution is immense and includes selenium and mercury contamination.
- In addition to damage to the natural environment, community members have concerns regarding the health impacts and damage to their physical bodies from the power plant. Extractive industries have led to chronic diseases associated with air pollution. The whole lifecycle of the power plant includes hazardous materials, from cutting up the land (creating dust) to exhaust from power plants into the air. One meeting participant has worked in public health with the Navajo community and observed adverse health impacts in the community, including:
    - Children with respiratory and cardiac problems, including observable increases in children with asthma.
    - Cancer and respiratory problems (emphysema, COPD, asthma).
    - Diseases seen in the community take years to develop.

  Another meeting participant noted that a lot of community members have physical and mental disabilities. People in the Navajo Nation have high rates of cancer, cardiovascular disease, and obesity, and the environment is compounding those health issues.

Receiving Water Characterization

- FCPP is on the Navajo Nation, a few miles south of the San Juan River. Water is withdrawn out of the San Juan River upstream of the power plant and piped to a manmade lake called Morgan Lake. The water is recirculated there and used for cooling in the power plant, and discharges from the FCPP are sent to Morgan Lake. Water is also discharged from Morgan Lake into a small wash called No Name Wash, which flows to the Chaco River, which flows into the San Juan River.
    - Morgan Lake was created by damming an unnamed tributary (which they believe is No Named Wash) that used to flow into the Chaco River and then the San Juan River. EPA has not recognized that Morgan Lake is a Water of the United States, allowing FCPP to continue discharging into it as a cooling pond. This is important because if receiving waters are not characterized correctly, they will not be regulated.

Ongoing Concerns and Issues – Clean Up, Oversight, and Transparency

- The former owner (Australian company) left their ownership because of toxicity issues. Arizona Public Service (APS) took over the power plant, but they were ill-equipped to deal with the legacy issues of FCPP and the Navajo Mine.
    - Companies have said that the polluted Four Corners area will be cleaned up but community members have not found that to be the case after 60 to 70 years of pollution. There have been numerous industries -- uranium mining, hard rock

mining, and coal, oil, and gas industries – to list as examples of previous failures to take responsibility for clean-up.

- The FCPP lease site is on Navajo Nation lands. The Navajo Mine is owned by the Navajo Transitional Energy Company (NTEC), which is a Navajo tribal corporation. NTEC owns seven percent of the FCPP, and they have tried to own an additional 13 percent. Due to this investment, community members are concerned that NTEC will continue operating the coal-fired power plant for as long as possible. There is a lack of transparency at NTEC, including information about its operations and communication to the Navajo people about the toxicity of the pollutants from the FCPP.
    - The FCPP provided jobs with good pay for people in the community; however, the health and livelihoods of the communities along the San Juan River have been heavily impacted.
- Regarding the disposal of CCR from FCPP, community members felt that APS has done a poor job of monitoring and handling potential contamination from the disposal. The community is concerned about water plumes, especially near the Chaco Wash that flows into the San Juan River. The local population uses the San Juan River for recreational and agricultural purposes. In his report, Dr. Campbell made some recommendations for cleaning up the waste.
    - Community members noted that there are many coal ash pits that are not lined, and community members are not aware of whether the plant, regulatory community, or other entity is checking whether toxins are leaking into waterways. There is very little safe water on Navajo land.
    - One community member who worked at the FCPP recalled taking a truck filled with fly ash and dumping it on angled land, where it would likely runoff into the river when it rained.
- Community members voiced concerns regarding employee safety when performing coal ash handling at the FCPP. Contractors who work on the site go through a basic introduction to safety but the training did not really apply to work at the FCPP. Based on personal experience, one community member noted that they were never taught about the composition of the coal ash and the health issues associated with it. During the contractor's time at FCPP:
    - Contractors climbed scaffolding to reach the top of smokestacks without safety harnesses and there were reports of gear and tools falling on employees.
    - Operations included vacuuming coal ash with a hose. The personal protective equipment (PPE) included a basic disposable face mask, gloves, and safety glasses. The ash gets all over the worker and into eyes and mouth even with the PPE in place.
    - There were always tight deadlines at the plant and no lunchbreaks during first few weeks on the job. The contractor complained to supervisors about the lack of lunchtime and the working conditions.
- Community members noted that to date, there has not been a single site where extraction of a natural resource on Navajo Nation has been remediated, reclaimed, or restored to its state before extraction. The community feels the lingering effects of outside corporations

or state entities who are extracting those resources, which include uranium, oil, helium, and coal. There is a sad history of extraction that speaks to failure of the U.S. federal government to fulfill its responsibility to ensure that the land remains livable with unpolluted land and clean air and water.

- For example, the 1979 Church Rock Uranium Mine spill was the largest radioactive waste spill in the U.S. It released 94 million gallons of acidic radioactive waste into Puerco River, contaminating over 80 miles of their waterways that had been used to provide water for livestock, crops and water well replenishment. This is an example of why frontline communities should be consulted because they have generations of land knowledge that has been passed down.
    - Water wells that had been historically used are now polluted from the uranium mine spill. Local people cannot drink the water, but still use it to bathe and shower.

- It is important for EPA to conduct meaningful outreach and education about air and water quality and to communicate that information in the native language.

EPA Permitting

- EPA needs to stop offering leniency to extractive industries. It took about 20 years to get a National Pollutant Discharge Elimination System (NPDES) permit addressing pollution into the San Juan River. This has been an area of neglect with concerns for the cyclical nature of air and water pollution.
    - A permit was last renewed for FCPP in 2001. Permits are supposed to be renewed every five years. The local community noticed that the permit was behind in 2010 and notified EPA that the permit had not been updated.
        - The Navajo Nation had adopted water quality standards that apply to some of the streams. Some of the ELGs were also stricter. The permits needed to be renewed to reflect more stringent regulation.
    - The Navajo Nation ended up suing EPA to get the permit updated; this is an environmental justice issue because EPA did not do its job. This resulted in multiple legal challenges; the Navajo Nation should not have to sue EPA repeatedly to get legal permits. A summary of the timeline included:
        - After initial suit, EPA agreed to a date to renew the permit in a settlement. EPA issued a permit, but the community challenged the permit in front of EPA's Environmental Appeals Board (EAB) because the permit was defective. In response, EPA withdrew the permit, which added a couple more years to the process of getting a renewed permit for FCPP.
        - EPA issued a new permit but the community identified issues with it, including one related to the Steam Electric ELG, and brought these issues to EPA's EAB. The EAB upheld EPA's permit, and the community appealed that decision to the 9th Circuit Court of Appeals. They just entered into a settlement unrelated to the Steam Electric ELG Rule to address their concerns.

- In the past, EPA has used its discretion to the benefit of the polluter on numerous occasions.
    - The first example is the decision to not classify Morgan Lake as a Water of the U.S. and not regulate its discharges. The lake receives water from the San Juan River and discharges water back into the San Juan River. EPA has acknowledged previously that Morgan Lake was created by damming a stream that had valuable ecological resources.
    - Previous Steam Electric ELG Rules were also in favor of the polluter. Community meeting participants argued that bottom ash discharges should be eliminated as soon as possible, but EPA allowed the polluter to continue discharging bottom ash until the last possible day.
    - There is an enormous coal ash lake next to the FCPP. For years, the power plant discharged coal ash mixed with water into the lake as a surface impoundment, which eventually leaked. The leaks surfaced near the Chaco Creek, which flows into the San Juan River. This forced APS to collect the leaking water and pump it back into the same surface impoundment. This has created what appears to be a perpetual pump-back system. EPA needs to regulate those seepages but has not done so in the permits.
    - EPA should use its discretion to protect public health and the environment in the future.
- The Four Corners area includes three EPA regions (6, 8, and 9) and these regional offices need to coordinate.

Exhibit B. Kentucky Community Outreach Meeting in Support of the Proposed Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category

May 17, 2022

Format: Virtual

Presenters:

- Richard Benware: EPA Headquarters Office of Water (OW)
- Julia Monsarrat: EPA Headquarters OW ORISE Fellow

General Topics and Examples

Comments Regarding the Effluent Limitations Guidelines and Standards (ELG) Rulemaking

- Community members asked about the timeline for sharing feedback with EPA.
    - OW Response: EPA explained that the purpose of the current meeting is to hear from the community about what they would like included in the supplemental ELG rulemaking, ways to improve community understanding of the rule and to engage in further dialogue, and concerns within the community. EPA is interested in setting up subsequent meetings after proposal to explain the analyses they performed and listen to the community's opinions on the proposed rule.
- Community members asked if EPA is primarily focused on the Trimble Power Plant for the Steam Electric ELG.
    - OW Response: EPA explained that they are interested in any coal-fired steam electric power plants in the U.S. that discharge the regulated wastestreams.
- Community members were concerned about leachate, since the Trimble Power Plant is located along the Ohio River, and asked whether EPA plans to require the Trimble Power Plant to use a specific treatment system for all leachate discharges.
    - OW Response: EPA explained that they will be soliciting comment on whether plants should co-treat flue gas desulfurization (FGD) and leachate, as some plants do this practice. EPA has identified locations where plants treat leachate (alone), including with zero discharge treatment. Leachate will continue to be generated at landfills regardless of how well a cap is designed and EPA is looking at treatment of leachate beyond FGD discharge.
- Community members noted that in 2018, EPA proposed to operate wet bottom ash systems and purge 10 percent of transport water by volume on a rolling monthly basis. The community members considered this to be a loophole and hoped that EPA would eliminate it.
- Community members requested that EPA consider zero discharge for all wastestreams. Zero discharge might be the best available technology (BAT) for at least some of the wastestreams at Trimble Power Plant and other facilities.

- Community members asked whether evaporative systems could be used in the Trimble Power Plant.
  - OW Response: EPA noted that some coal-fired power plants in the U.S. and other countries use thermal treatment for discharge.
- Community members said that even though it might be more expensive for companies to remove pollutants from wastestreams, it is more costly for human life if they do not remove them.
- Community members asked EPA to require the state to conduct testing. They have not been able to find data from state testing and find it difficult to communicate their concerns to the state.

Environmental, Human Health, and Other Community Concerns

- Community members expressed concerns about the pollutants from the Trimble Power Plant. They indicated that they did not know what pollutants are being discharged and whether those pollutants present health concerns to people swimming and fishing in the Ohio River. The plant is located in a community with EJ concerns, including air and water pollution from multiple sources. Participants wanted to know how the rule would change pollution from the plant and in the Ohio River in general.
  - OW Response: As part of this rule development, EPA is currently looking at impacts from the Trimble Power Plant and other plants along the Ohio River. EPA is analyzing factors including carcinogens in downstream drinking water, fishing and swimming impacts, and threatened and endangered species. Regarding changes in pollutant loadings from the plant and into the river, previous rulemakings by EPA have set more stringent limitations on heavy pollutants and nutrients. The new rule aims for even more reduction from bottom ash and leachate for the same pollutants and carcinogens.
- Community members are concerned about water quality, despite a 2019 drinking water study conducted by the state that did not show significant levels of pollutants. Community members indicated that other states have established lower limits than the lifetime advisories from EPA. They would like to see this addressed, since people are exposed to multiple chemicals from multiple sources of pollution.
- There is a proposed gun range in the area that could affect water quality in the creek. One of the community members is affiliated with an organization that is opposed to the proposed gun range.
- Community members explained that years ago, they were involved with the Red Penn Landfill (near the Oldham-Jefferson County line), a 151-acre Superfund site with buried drums. The leachate from the landfill travels underground to Floyds Fort Creek and other waters, eventually reaching the Ohio River. There are concerns about paint cans that could contain lead or PFAS seeping from the landfill and entering these waters. The federal government was involved in the Red Penn Landfill cleanup, and the landfill was eventually turned over to the state, but it was not capped for many years. Community members said that orange leachate comes out underground and runs into Floyds Fork Creek (see Receiving Water Characterization section).

  - Floyds Fork Creek runs through the Parklands of Floyds Fork, which has walking trails, kayaks, and canoes. The park is heavily used by the public and spans several counties.
  - Community members said that they do not know whether EPA has tested water downstream of the landfill or whether there are requirements to test the water.
  - The Floyds Fork Wastewater Treatment Plant is in the area, along with other subregional treatment plants.
  - One community member recently participated in a survey with a wildlife agency and documented nearly 71,000 dead fish resulting from an upstream fire and a deoxygenated plume that extended downstream.
- There are different types of outdoor recreation in the local waterways.
  - There are many fish in Floyds Fork Creek, such as catfish, sunfish, and bass. Many people fish and seine for crayfish.
  - Community members enjoy fishing, kayaking, and canoeing on the Ohio River. In general, there are many opportunities for outdoor recreation in Oldham County, and many people use the waterways.
- Community members said that they thought that EPA must consult with the U.S. Fish and Wildlife Service and prepare a biological opinion on the impacts from steam electric power plant discharges.
- Community members expressed concerns about environmental quality in the west end of Louisville.
  - There are 11 large industrial plants in this area. Community members said that residents in this region die 10 to 12 years earlier than residents living in the east end of the city. Companies such as Dupont (now Chemours), Dow Dupont, and Lubrizol used to be located in the west end of the city.
  - The west end of Louisville has a higher proportion of Black residents relative to the rest of the city. In this area, Rubbertown in Jefferson County has a lot of underserved and overlooked residents. No one from that area participated in the meeting, but community members indicated that there are likely many EJ issues in that region.
  - Community members said that there are heavy fumes in the west end and no walking trails. Chickasaw Park is located in this part of the city.
  - There is a high rate of illness and cancer in this area. Many Rubbertown residents are low-income and cannot afford high-quality medical care.
  - The region is also a food desert.
- In the east end of Louisville, there was a proposal to add walking trails near a landfill, and community members fought it because of the fumes.
- There are rumors in some part of town that EPA has told residents to put tarps on the ground before children play outside.
- Community members said that emissions from the Trimble Power Plant can be carried for miles, and a lot will land on the ground and be washed into the aquifers. As a result, they expect that many local waterways could be affected.

- There are high rates of cancer in Louisville. In particular, community members know many people who have had kidney cancer.
  - There is a cancer center in Louisville that might have more information on local cancer rates.
  - There are notable rates of brain cancer in the community of Fern Creek. Cedar Creek, a major tributary to Floyds Fork Creek, runs through this area.
- Community member asked whether EPA was considering the effect of water quality on wildlife.
  - OW Response: EPA confirmed that they review this topic as part of the Steam Electric ELG.
- Community members asked whether EPA was considering PFAS and "forever chemicals" as part of the Steam Electric ELG.
  - OW Response: EPA explained that EPA has an Agency-wide PFAS action plan.
  - Recent local news stories have reported high concentrations of PFAS in Henderson, Kentucky, where Teflon pans were being recycled.
  - The local water company currently tests for 16 to 17 PFAS. Community members said that EPA will be requiring them to test for 29 PFAS.

Receiving Water Characterization

- Floyds Fork Creek flows into the Salt River, the Ohio River, and ultimately the Mississippi River. It runs through five counties and includes many tributaries.
- Currys Fork is a large tributary to Floyds Fork Creek.

Ongoing Concerns and Issues – Clean Up, Oversight, and Transparency

- The public is generally not aware of potential pollutant exposure from Trimble Power Plant.
  - Community members receive marketing newsletters from Trimble Power Plant with updates on news such as treatment technologies. They only hear the positive aspects of the power plant from the utilities, and they do not know if the information is accurate. However, they have doubts about the health risks from the power plant. They are not aware of anyone taking water samples upstream and downstream of the power plant, and they do not know if there is an issue in the river.
  - Community members said it would be helpful if Trimble Power Plant was required to regularly post information to a website, especially if that information was presented for a general audience.
- There is an interest in press releases from EPA. Oldham County has a newspaper that would publish press releases written for the general public.
- It might be possible for EPA to submit a public service announcement to local radio stations. Louisville Public Media has covered local PFAS issues.
- There is a substantial Spanish-speaking population in the Louisville area. For example, many Hispanic employees work on horse farms in Oldham County. As a result, community members recommended that EPA publish materials in Spanish.

Exhibit C. North Carolina Community Meeting in Support of the Proposed Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category

June 23, 2022

Format: Hybrid

Presenters:

- Richard Benware: EPA Office of Water (OW)
- James Covington: EPA OW
- Julia Monsarrat: EPA OW ORISE Fellow

General Topics and Examples

- Belews Lake community is widely spread out over four counties, contributing to the lack of understanding on environmental pollution and human health concerns.
- One community member remarked that the Clean Smoke Stacks Act was passed 20 years ago that improved air quality but increased water pollution.
- Most community members express concern on the coal ash soil and water contamination but have been told that the ash is "clean" by industry. A community member feels that Duke Energy does not accurately communicate the potential hazards of the ash and other pollution due to the potential liability.
- Many surrounding communities who would like to test their water do not have adequate water sampling equipment.
- Community members requested that an independent contractor frequently collect soil and water concentration data from Belews Creek and post the information on a publicly available website as they distrust Duke Energy.

Comments Regarding the Effluent Limitations Guidelines and Standards (ELG) Rulemaking

- Community members would prefer zero discharge at Belews Creek Steam Station since the technology (*i.e.,* membrane filtration) is available to achieve it, could be installed quickly, and would treat bromide. They do not want NC DEQ to decide which technology is best to implement.
- What is the timeline for proposing a rule and how will EPA use information from this meeting?
    - OW Response: EPA plans to publish revisions to the Steam Electric Rule in Fall 2022. EPA would like to hold one or more public hearings after the proposed rule, and there will be a 90-day public comment period before issuing a final rule. EPA would like to gather feedback from community members on health and socioeconomic impacts from power plants, other industrial sources, and other background concerns.

Community Impacts Caused by the Power Plant

- A Black and low-income community established in the 1970s was negatively impacted by the Belews Creek Steam Station, including coal ash disintegrating paint from houses and contaminating groundwater. Banks stopped loaning money due to the contamination, and many people left because the water and soil was contaminated. Overall, the community does not feel that their concerns have been heard by industry representatives, permitting authorities, or lawmakers.
- The community expressed concern that the elementary school closest to the power plant is expected to close in response to the Dan River coal ash spill; they expressed that schools are essential to neighborhoods. In addition to children, other vulnerable populations in the community include rural, communities of color, elderly, and those that have a harder time affording and accessing healthcare.
- Community members estimate that effluent from the power plant killed 90 percent of fish species in Belews Lake (a cooling pond) which previously was a food source. Most locals are aware of the pollution and no longer fish in the lake; however, there are tourists and community members with language barriers that do still fish.

Economic Concerns

- There are three new businesses in Madison that are tied to the Dan River, including tobacco farming, and community members expressed concern that inadequate power plant wastewater treatment would impact those businesses.
- Other economic concerns include 70 percent of children receiving free and reduced lunch, and most schools being designated as Title I (children from low-income families comprise at least 40 percent of enrollment). Parents who have environmental pollution concerns may not have time to come to a community outreach meeting as they are working multiple jobs.
- As a result of the coal ash spill, there is a concern that the tourism industry will be affected as more people move away. A community member noted there is a campground located near the Dan River.
- Community members also expressed a desire for the pollution fines that Duke pays to go towards benefitting community members. Home values are very low, and many community members cannot afford to move.
- The nearby Miller-Coors Plant closed that previously employed 300 people. The plant did not publicly give a reason for its closure, but community members suspect there were source water quality issues as it was drawing from the Dan River.

Human Health Concerns

- A community member expressed concern on selenium and bromide concentrations in Belews Lake, and overall concern on heavy metals in well water. There is a concern that even though some pollutants are discharged in small concentrations, chronic exposure can impact health.
- In the years following the coal ash spill, the municipalities of Eden and Madison had high total trihalomethanes (TTHMs). Trihalomethanes (THMs) may form in the finished

drinking water as the water moves through the distribution line due to elevated bromide concentration. Some communities have resorted to venting water from fire hydrants to avoid THMs; rural communities do not have the resources to do this.

- Specific impacts include needing to buy bottled water to bathe young children and to use as drinking water.
- Many community members do not have health insurance. There are unusually high rates of cancer, diabetes, skin disorders, and reproductive issues, as compared to other counties in NC. Children especially have high rates of bronchitis and asthma.

Other Background Concerns

- Although community members may receive SNAP benefits, there are very few grocery stores in the area, and the community is considered food impoverished by USDA criteria. In addition, there is very little public transportation, and gas is expensive.
- Internet access is limited and is more likely to be available in households with school age children.
- Poultry contamination is concerning, including *E. coli* discharge into streams from uncovered litter piles. Due to national security concerns, these facilities have limited permitting, and community members do not know where they are located. In addition, industrial poultry facilities cause the closure of smaller, family-run operations.
- One community member also expressed concern on 1,4-dioxane discharges stemming from agricultural applications (*e.g.,* tobacco). NC DEQ is planning to establish a discharge level of 0.2 parts per trillion (ppt); however, analytical instrumentation is only able to reliably detect 1 ppt. This may cause businesses to relocate as it essentially prevents them from using the chemical. EPA has not taken formal action on 1,4-dioxane, even though studies have been on-going since the 1970s. The community member would like EPA to establish the threshold instead of the state.

- Other industrial activity in the area includes logging, textiles, and furniture finishing, who have not adequately addressed their environmental pollution. Furniture finishing is the only major employer in Stokesville.

Additional Communication

- There is no printed newspaper in the community near Belews Lake, and community members suggested mail-based outreach or a canvassing effort to notify residents of the next community outreach meeting. They also suggested that municipalities be notified of the next meeting, and in particular, those in the public health department. There are digital newspapers, including Stokes News and Rockingham Now, that could also be used for outreach.

Exhibit D. Texas Community Meeting in Support of the Proposed Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category

June 30, 2022

Format: In-Person/Virtual

Presenters:

- Richard Benware: EPA Office of Water (OW)
- James Covington: EPA OW
- Julia Monsarrat: EPA OW ORISE Fellow

Comments Regarding the Effluent Limitations Guidelines and Standards (ELG) Rulemaking

- **Supreme Court Ruling from June 30, 2022:** The community is curious about how the supreme court ruling that restricts EPA's authority to mandate carbon emissions reductions will impact the Steam Electric ELG.
  - OW Response: As this was a recent event, EPA will need to wait to respond following review by attorneys to determine how or whether this ruling will impact other EPA rules going forward. This ruling was specifically for greenhouse gas emissions (GHG), which is covered under a different law than the ELGs. Under the Clean Water Act (governs water rules), there are set factors that EPA needs to consider, and this statute has been decided over the years.
- What is the timeline of the rulemaking, including assessing these comments and proposing the rule?
  - OW Response: EPA plans to sign the proposed rule in the fall, then there will be a comment period. EPA analyzes the comments and makes changes to the analyses. This process will likely take until 2024 for a final rule.
  - Today is screening level meeting where EPA will hear what the community wants to express. There are other opportunities for providing comments. EPA will post a draft version of the supplemental rule to its website and officially publish in the Federal Register Notice (FRN). Following publication, there is a formal comment process where anyone can submit comments for the federal record and EPA responds to those comments. Following proposal of the rule, EPA will hold public hearings and is looking to hold in-person meetings at communities where there are EJ concerns. EPA will consider input from today's meeting and any comments submitted or provided at public hearings. EPA will consider comments received during and after proposal of the rule when developing the final rule.
- What technologies are EPA considering for the supplemental rulemaking?
  - OW Response: Under this statute, EPA evaluates the technology, along with a review of pollutants. This knowledge of the treatment technologies drives

decisions. EPA looks at costs for the technology, impacts from pollutants, and improvements (pollutant reduction) by installing treatment technologies. EPA is in the process of finalizing technology selection for the proposed rule and is looking at potentially more stringent options like membrane filtration and spray dryer evaporators that can remove heavy metals and other pollutants.

- Community members asked about public health impacts from the pollutants that EPA is trying to regulate and what impacts would be to the community. In addition, asking how EPA weighs public health vs. costs.
    - OW Response: In general, ELGs are based on economic achievability and availability factors. EPA cannot make/change decisions based on a cost-benefit analysis, specifically prohibited by the CWA ELG program. In previous Steam Electric ELG rules, EPA has addressed discharges of heavy metals and nutrients. EPA conducts analysis to evaluate improvements in water quality and decreases in concentrations of pollutants in fish. Current rule does not address halogen (bromide, iodine) and dissolved metals. (See EPA website for more details on pollutants and analysis performed for the 2020 rule: https://www.epa.gov/eg/2020-steam-electric-reconsideration-rule).

Environmental, Human Health, and Other Community Concerns, Including Access to Information

- The community is concerned about migration of pollutants from the Parish Plant via the groundwater. Using Ashtracker.org, the participant looked at groundwater monitoring wells for 16 active power plants, finding that almost all had pollutants above federal limits. The participant specified that almost every well at the Parish Plant had pollutant levels that exceeded federal standard levels.
- The community is also concerned about the impacts these exceedances may have on the community. The community would like more information on how the water and soil is being impacted due to the Parish Plant, how widespread the pollution is, and if EPA can make that data available to the public so that they can stay informed and avoid highly contaminated areas.
- The community would like to see EPA engage with the state and county public health offices to keep the community informed if there are high cancer ratings. One attendee noted a study from Rice that looked at health benefits of closed coal plants and identified statistical deaths from all plants in Texas. The Parish Plant's particulate matter (air emission) accounted for the greatest number of statistical deaths (178 every year) in Texas.
    - OW Response: The ELG program normally does not coordinate with state and local health departments. Other parts of the Agency do engage in those types of activities. If there is information about a plant that someone would like to be brought up, EPA can pass along to the state.
- Meeting participants know that some lakes have been exposed to pollutants from plant discharges (downstream). People go fishing and don't understand why they are getting sick. Communities around plants are using this water on lawns and parks around homes. How do we address this and get it cleaned up?

  - OW Response: Some of those issues are under the disposal rule (Coal Combustion and Residuals (CCR) Rule) implemented by EPA's Office of Land and Emergency Management (OLEM). There is a potential that plants close to surface waters would fall under OW purview. For example, the Maui case ruling found that if plant is right up against a surface water body, then you could have a functional equivalent discharge that could be captured in ELG requirements. Downstream cleanups of discharges happen under the EPA Superfund program. With this rulemaking, EPA is looking at future discharges to help stop pollutants getting into the environment.
  - One of the wastestreams being evaluated is legacy wastewater. This wastewater is still on plant property. Although the ELG does not address legacy pollution, it can evaluate ways to not add more.
- The attendee indicated that the Parish Plant is a violator and has concerns of the effects of ash. The community would like more information to answer questions such as: 1) What are the parameters of the pollution around the plant and impacted mile radius/downstream area? 2) How can we access the data to determine what we need to communicate with the public?
  - OW Response: As part of the ELG development, EPA conducts a downstream analysis. Some of these contaminants do not break down and can travel dozens of miles and make it downstream to water treatment plants. There is a point where it gets diluted from other streams. That type of data will be in the rulemaking record. EPA can help point out where the data are available. (See https://www.epa.gov/eg/2020-steam-electric-reconsideration-rule-documents that includes EPA's engineering, environmental assessment, and cost and benefits analyses documents from the 2020 rulemaking and docket (record) user's guide. Similar documents and docket materials will be available for the proposed supplemental rule.)
- **Scrubbers on FGD Systems:** The community around the Parish Plant is aware that the plant has flue gas desulfurization (FGD) systems, many of which do not have air pollutant control scrubbers. One attendee mentioned that only one unit out of four is equipped with a scrubber. The attendee wants to know what impact that has on the pollutants in the wastewater.
  - OW Response: Wet-systems (scrubbers) are sometimes needed to meet Clean Air Act (CAA) regulations; however, plants may use dry air pollution control systems and truck solids to a landfill. Under the CAA, a plant might be small and exempt from requirements. The ELG covers wastewater from FGD (wet scrubber) systems. Some plants are able to recycle and reuse this water, others use evaporation ponds, and then there are ones that need to discharge (unable to reuse). Under the CAA, if plants are grandfathered, the ELG will not impact them. However, the ELG could have indirect impact, and the plant may choose to close.

Other Sources of Environmental Pollution in the Area

- The community is concerned with the sprawl in the area and how that creates air pollution and ozone issues. One community member noted that they are in non-attainment and have been since 1979. There is also concern about the oil wells along the Fort Bend toll road from East Bend to Richmond. People are having problems with oil well seepage.
- Another attendee mentioned the large portion of the population getting cancer possibly due to the oil wells, nearby chemical plants, or leachate problems coming from the landfill.
- Participants are concerned about new homes and schools being built near Winfield Lakes. Currently there are odor problems, and the community would like information on potential pollution sources in the area (*e.g.,* leaks).
- Exposed land with leachate can be seen as well.

Community Needs for Monitoring, Oversight, and Guidance

- One of the noted environmental concerns described above is the potential for pollutants to migrate via groundwater (*e.g.,* from landfills and surface impoundments). Community members asked about well monitoring in their area and whether EPA reviews the groundwater monitoring results or manages the well monitoring. Community members also do not trust that the Parish Plant has stopped intaking coal in their impoundment or fully monitoring the groundwater as required by the CCR Rule.
    - <u>OW Response:</u> EPA implements the CCR Rule through OLEM. The CCR Rule has requirements to clean up existing coal ash storage and to conduct groundwater monitoring from landfills and surface impoundments at downgradient locations. Power plants perform the assessment to establish a baseline (needed to determine migration) and outreach to remediate any groundwater contamination. EPA has the power to initiate enforcement actions. The public can look up data for facilities under the CCR part A and part B rule. Some plants have asked for extensions to meet requirements, and others say that their storage is protected ("safe") even if unlined. EPA's website tracks EPA actions. For the supplemental rule ELG, EPA is evaluating requirements for leachate discharges.
- As EPA has determined a new rulemaking is needed, what kind of guidance can be given to people to make sure they are safe (*e.g.,* children playing outside and people being outdoors) until limits are being met?
    - <u>OW Response:</u> As noted earlier, under the CWA, ELG limitations are based on technology. It is the role of the state (Texas) department to looks at water quality standards – are they being exceeded for a given waterbody and its uses or do they need to issue a fish consumption advisory. When a discharge permit is written by the state, they must look at both technology and water quality requirements and apply the most stringent limit.

NPDES Permitting - Accountability and Transparency

- The community does not believe that the Texas DEQ cares about EJ and that they do not take demographic information into consideration when writing permits. The community wants to know if EPA will review TDEQ permits and whether due process is completed, and if EPA can give direct oversight to the state department.

- OW Response: Primacy is with the state agencies. EPA does have discussions with states, as partners, to ensure regulations are being adhered to. There is some state discretion. EPA does not plan on looking at state permitting authority performance as part of this rulemaking. We have seen some states do more about issues being reviewed for this rule (*e.g.,* NC and dewatering of ponds). TDEQ is participating in this meeting virtually to hear comments and concerns.

- The community would also like more transparency and would like to have more input with Texas DEQ when creating permits. There was an overall sense of distrust and anger towards the DEQ. Many community members agreed that they would like to see the Texas DEQ disbanded. They believe EPA is too disconnected at the county and city level. One way to improve trust is through transparency and being able to access data publicly.
- Community members would like to see Texas DEQ take demographics (EJ concerns) and cumulative impacts into account when writing permits.

Exhibit E. Florida Community Meeting in Support of the Proposed Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category

September 7, 2022

Format: Virtual

Presenters:

- Richard Benware: EPA Office of Water (OW)
- Julia Monsarrat: EPA OW ORISE Fellow

Questions and discussions with the community members are summarized below.

Comments Regarding the Effluent Limitations Guidelines and Standards (ELG) Rulemaking

- Do EPA's assessments only apply to the plants themselves, or is EPA also looking at temporary storage facilities and/or auxiliary sites?
    - OW Response: This analysis will not be a catch-all for all sources; EPA uses an annual-basis analysis. Combustion residual leachate can come from landfills and surface impoundments. EPA evaluates plant utilization and tends to look at large pollutant sources, such as those identified in EPA's Toxic Release Inventory (https://www.epa.gov/toxics-release-inventory-tri-program). Those sources may capture the temporary storage areas if they cross the reporting threshold. If you are aware of storage areas outside of the primary sources that EPA identifies, we would be interested in further information. For example, coal ash storage where leaching may be occurring might be in the scope of the analysis.
- EPA's analysis considers both the financial/economic cost to regulations along with the impact on health and long-term ramifications for environmental justice. How are these factors weighted?
    - OW Response: The Clean Water Act (CWA) includes a list of factors EPA considers for ELGs. EPA can make regulations based on best available technology economically achievable (BAT) across the industry. EPA asks, "Can the industry bear the cost?" We also look at non-water quality environmental impacts such as air emissions, soil impacts, and electricity generation. EPA has some discretion in weighing those factors. This is done at the Administrator level. The CWA prohibits EPA from using health impacts or cost/benefit weighting. EPA determines BAT and considers cost for overall reasonableness. The cost to the utility is not paramount. Even in other rules, cost is a factor but is used in determining the overall achievability. There have been rules with very high costs where EPA has found that something is not economically achievable or could impact a particular location. In those cases, the economic factors can take a front seat (*e.g.,* a rule that would impact a remote town in Alaska with only one

employer). In general, EPA asks, "Is there a better technology to remove or eliminate discharges that do not have non-water quality environmental impacts?" EPA performs a nationwide analysis of electricity generation for this particular sector using the Integrated Planning Model (IPM) - Power Sector Modeling | US EPA. EPA reviews forecasted changes to electricity generation for decades. Other questions include "Will this result in incremental closure of boilers or entire plants?" and "How is it impacted by other regulations?" After looking at all impacts, EPA weighs these factors to make a decision.

- Does the age of the coal-powered plant factor into the regulations and/or rules?
  - OW Response: Yes, this is a statutory factor that the Agency must consider.
- What is the timeline for producing and sharing the EPA regulations? Following the analyses, will there be a compliance deadline or compliance monitoring?
  - OW Response: EPA intends to propose a rule by the end of fall 2022[1] with a final rule established in 2024. Usually, it takes a few weeks to one month from signature to publishing as a notice in the Federal Register. EPA typically has a pre-publication version of the rule available on our website, Steam Electric Power Generating Effluent Guidelines | US EPA, and will post the study reports to the website. All materials (including analysis results) will be available at Regulations.gov.
  - Following publication of the proposed rule in the Federal Register, a public comment period begins and typically lasts 90 days. As part of the proposal, EPA will ask for comments on compliance deadlines and reporting. The ELGs have some "built-in" monitoring requirements, but there are other pollutants that EPA's regulatory technologies can control. EPA told community members to feel free to provide comments on specific pollutants of interest that would help with transparency and accessibility to data. EPA also asked, "is there something community members would like to see in the rule regarding information and access?"
- How do we ensure that the public and utility get notified of the draft rule rather than reading the FR every day?
  - OW Response: EPA strives to be better communicators, such as setting up this meeting. EPA does not intend on reaching out to each community member but EPA's main website (U.S. Environmental Protection Agency | US EPA) will have an announcement and likely information will be sent out to the news media. EPA encouraged community members to be on the lookout for the proposed rule in late fall. If individualized outreach would be welcomed, we could look at doing that (not historically done).
- When the rules/regulations associated with effluent releases are approved, what must the utility do to comply with the rules/regulations?

[1] At the time of the meeting, EPA planned on proposing the supplemental rule by the end of fall. However, the timing of the rule will likely be winter 2022/2023.

- OW Response: These rules are implemented by the state entity through a National Pollutant Discharge Elimination System (NPDES) permit. In a few exceptions, EPA is the permitting authority. When the permit is issued, any rule that has been signed, promulgated, and included in the Code of Federal Regulations (CFR) – see eCFR :: Title 40 of the CFR -- Protection of Environment - the state is required to include the requirements of the ELGs in the permit. When issued by the state, permits are open for comment by the public. Regarding the time frame for the Steam Electric ELGs (40 CFR 423), there may be some lagging permits not yet up for renewal when the rule is published. States will update the requirements at the time of the permit renewal -- typically a 5-year permit cycle. Once the permit is in effect, the plant must meet requirements. EPA is looking at some additional reporting requirements as part of the rule. Note that the permit for operating landfills is separate from the NPDES permit.

- How will the rules/regulations be influenced by the goal to make substantial reductions in negative environmental impact by 2030 (as noted in the Inflation Reduction Act (IRA))?
  - OW Response: Regarding the greenhouse gas (GHG) reductions, the EPA Administrator has introduced targets and actions in the IRA. EPA is in the process of looking at those impacts, and hopefully by the final ELG rule, OW will be able to take any other actions into account to see impacts in the electricity market. The Administration is ensuring the rules are harmonized and cumulative impacts are taken into account, such as unit/plant retirements, economic impacts, pollutant benefits, energy market.

Receiving Water Characterization

- One of the community members asked about the area of impact that EPA considered, noting that there is a possibility of tidal flow along the Trout River, and discharges from Northside Generating Station (Northside) could impact tributaries outside the range shown in the presentation (1-mile and 3-mile radii). The community member recommended conducting both a downstream and upstream analysis because the river is tidally impacted in this area, and the community member personally has conducted research on the sediment and lower basin of the Trout River directly impacted by Northside.
  - OW Response: EPA noted that the map shown in the presentation was used as part of the EJ screening analysis to evaluate the demographics around the power plant to determine if the community had any EJ concerns. In its rulemaking analysis, EPA is looking beyond those boundaries, including air emission impacts and impacts to downstream waters (pollutant loadings and health impacts) that can be as long as 300 kilometers (180 miles) downstream.

    EPA noted that this input is helpful to understand the community and the concerns with specific water bodies. The reverse flow is an aspect that EPA may want to consider as it could impact fish in different areas not currently considered. EPA welcomed any research or reports that could be provided or further discussion that could be via public comments (following rule proposal in the fall) or a separate meeting.

Environmental, Human Health, and Other Community Concerns

- The community along Trout River is already a heavily impacted socioeconomic community. Along the Trout River, materials accumulate in the sediment, such as mercury (see discussion above regarding research).
- Many of the tributaries and the Trout River are impacted by fecal coliform. These areas are communities with EJ concerns.
  - OW Response: EPA's benefits analysis looks at fecal coliform and other pollutants in the surface water. As noted earlier, EPA may also consider evaluating the Trout River and upstream impacts.
- The community is concerned with impacts to fish from pollutants discharged by Northside, along with the air emissions and ash stored at the plant. Community members asked if EPA would be looking at combined effects of pollutants.
  - OW Response: Total cumulative impacts are of interest to the Agency and any information that community members can provide. The Agency is striving to do better at cumulative impact assessments. Regarding cross media contamination, EPA looks at releases to air and water. This ELG rulemaking will have an assessment of baseline pollutants in the air especially with multiple plants contributing to an area. EPA is looking where there are multiple pollutants: 1) is there a joint toxic action documented? 2) are the pollutants synergistic vs. antagonistic? If there are multiple discharges reaching downstream waters, EPA is trying to capture the cumulative effects. For a nationwide assessment, it is challenging to look at all those specific areas. EPA urged attendees to look at the analyses for the proposed rule once available and provide any comments and feedback.
  - There are also some ongoing EPA air regulations.
- One of the foundations of this area is a thriving fishing community and industry – blue crab and other seafood. There are many subsistence fishers in the area. Florida residents consume a higher percentage of fish and thus need greater protection.
  - OW Response: When EPA evaluates impacts to human health from fish consumption, we primarily evaluate four cohorts divided into recreational vs. subsistence fishers, who have different consumption rates, as well as adult vs. child consumers. A national analysis will not be as precise regarding fish consumption in your particular area. It is helpful to know about the economic significance of the seafood industry.
- Recreational activities, including fishing (several fish camps), marinas, and dining, occur within sight of the plant. Just outside the 3-mile radius of the plant, the community has state and city parks where preservation activities and recreational activities occur, including swimming and walking trails. Community members noted that pollutant releases from the plant can impact many people.

- Community members noted that a high number of children in the area suffer from asthma.
- Another concern is that the community is subject to impacts from storm surge during extreme weather events. The challenges posed by storm surge seem to be increasing.

EPA Analyses for the ELG

- Are you going to do an environmental risk assessment to look at human health and ecological risk impact? Will it be a site-specific risk assessment?
    - OW Response: We perform a nationwide assessment and look at immediate receiving waters and downstream waters for the four evaluated wastestreams (flue gas desulfurization wastewater, bottom ash transport water, combustion residual leachate, and legacy wastewater). Our analysis looks at human health impacts (non-cancer or cancer impacts) and ecological benchmark exceedances. This is the same analysis EPA performed for the 2015 and 2020 rules. EPA's assessment is not akin to Superfund site-specific assessments with monitoring and environmental sampling. The ELG rules are more of a nationwide focus, but EPA does incorporate site-based factors into the modeling, including characteristics of the specific receiving water.
- One attendee asked if EPA would be testing animals (*e.g.,* fish) or water near the plant.
    - OW Response: EPA's analysis will look at impacts to humans from the ingestion of fish at both the immediate receiving water and downstream (*i.e.,* as pollutants flow down to other water bodies). EPA does not test the wildlife but does assess exposure to wildlife that eat fish (*e.g.,* mink and eagles). EPA also looks at impacts to sediment biota and water quality. As noted, the analyses are performed as a nationwide assessment and not specific to exposure for the Jacksonville community.
- Another attendee asked if EPA was evaluating both freshwater and marine waterbodies.
    - OW Response: EPA has both freshwater and marine National Recommended Water Quality Criteria (NRWQC) standards: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-tables.[1]
- Is there a federal maximum daily load for each of the toxins, especially for states like Florida which don't have maximums? Could this information be included in the report?
    - OW Response: EPA does include national criteria (*i.e.,* NRWQC) and other benchmarks in the analyses, but is unsure whether total maximum daily loads (TMDLs) are incorporated.[2] TMDLs can be allocated across plants, and if community members have specific knowledge regarding pollutants in the watershed, EPA can consider the information in any comments that are received on the rule.

[1] EPA's national-scale modeling excludes discharges to estuaries because the specific hydrodynamics and scale of the analysis required to appropriately model and quantify pollutant concentrations in these types of waterbodies are more complex than can be represented in the environmental assessment model.

[2] EPA does not currently incorporate TMDLs in either the environmental assessment or benefits analysis. TMDLs are local in nature and scope and would not be included in a national-scale analysis. To conduct local assessments, EPA would need site-specific data (*e.g.,* hardness, pH, temperature, etc.) from each receiving water.

- One community member noted other resources: 1) CDC website on vulnerable communities (https://www.cdc.gov/nceh/tracking/topics/PopulationsVulnerabilities.htm) and 2) Justice 40 Initiative (https://www.whitehouse.gov/environmentaljustice/justice40/).

Other Sources of Environmental Pollution in the Area

- Will the study include measures of carbon emissions? And the percentage of total Jacksonville area carbon emissions from Northside Plant?
    - OW Response: Yes, EPA's analyses will look at carbon emissions. The ELG will not directly impact air emissions; the changes in air emissions are based on shifts in electricity generation. EPA also sees shifts from high to low carbon emissions. EPA does not know offhand the percentage of emissions in the area from Northside, but the relative percentage will be in the record. EPA will have an index on the website for information, and there will be facility-specific information in the record.

Information Accessibility and Transparency

- EPA makes greenhouse gas emissions data available to the public through its Flight database. Does it provide similar public access to data related to liquid pollutant releases by major facilities? Attendees also have interest in specific information for the Northside Plant – what pollutants are being evaluated and would be regulated under the new rule? What are the impacts to health? There is a lot of testing/monitoring but would like information on compliance by the plant.

    - OW Response: The information is available on EPA's Integrated Compliance Information System (ICIS) website. It is a public facing data source for all major sources of discharges. The website has all required reporting, including pollutant concentrations or mass loading, and users can compare to limitations that EPA has set. There is a tool you can use to look at facilities of interest: https://echo.epa.gov/trends/loading-tool/water-pollution-search. EPA maintains this website to make the information more transparent and accessible.

    Note: information on pollutants, including impacts, is available in reports for the previous rulemakings. See https://www.epa.gov/eg/2020-steam-electric-reconsideration-rule and https://www.epa.gov/eg/steam-electric-power-generating-effluent-guidelines-2015-final-rule.

Additional Communication

EPA would like to have follow-up communication with the communities. EPA plans on writing a fact sheet that can be disseminated. Are there ways to improve communication with communities or ways to present/disseminate information?

- Community members provided contact details for some other community groups of interest including Jacksonville NAACP and Duval County Soil and Water. Additional thoughts on communication include reaching out to city council members (email lists of constituents) and posting flyers for additional meetings.

- Community members noted that regional information in one place on EPA's website would be helpful.
    - OW Response: EPA (HQ) interacts with EPA Regional staff and can pass along this comment to EPA Region 4 staff (see About EPA Region 4 (Southeast) | US EPA). EPA noted that there is also a website specific to each ELG rulemaking for the steam electric industry that has details. See links at Steam Electric Power Generating Effluent Guidelines | US EPA.
- Community members stated that it is a challenge to reach out to individuals and groups but noted that explaining information in a simple and easy format and noting the impacts that occur would be helpful (*e.g.,* to the angling community). The rule itself can be complicated to convey, and many people do not know what Environmental Justice means.
- EPA can work with community groups to facilitate the distribution of the fact sheet to community locations such as state parks or private facilities.

Community members can reach out to EPA for specific information on the rulemaking or EJ analysis. EPA will hold additional community meetings after the proposal, allowing community members to review the analyses and provide input. There will be two virtual public meetings open to any attendee (national level). In addition, EPA would like to continue engagement with community members located in communities with EJ concerns.

Appendix E: Distributional Analysis of Neurological and Cognitive and Cancer Impacts from Pollution in Downstream Surface Water Results

This section of the appendix presents additional results from the distributional analysis of neurological and cognitive and cancer impacts from exposures to lead, mercury, and arsenic in downstream receiving waters of steam electric power plants. The results are presented by relevant cohort groups for each health outcome – child subsistence and recreational fish consumers or adult subsistence and recreational fish consumers – and by income group – below the poverty line or not below the poverty line –, controlling for race and ethnicity.

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Table E-1. Modeled Total IQ Points under the Baseline and Change in Avoided IQ Point Losses under the Regulatory Options among Child Subsistence and Recreational Fish Consumers Exposed to Lead through Fish Consumption, by Income Group, Controlling for Race and Ethnicity

Cohort Group	Race/Ethnic Group	Income Group	Exposed Populations (a)	Baseline Total IQ Points (b)	Option 1	Option 2	Option 3	Option 4
Child Subsistence	White	Below the Poverty Line	6,830 (11.8%)	105,916 (11.8%)	0	0.00463	0.0194	0.0194
		Not Below the Poverty Line	51,132 (88.2%)	791,768 (88.2%)	0	0.0492	0.191	0.191
	Black	Below the Poverty Line	3,812 (23.6%)	59,436.7 (23.7%)	0.138	0.149	0.335	0.336
		Note Below the Poverty Line	12,312 (76.4%)	191,804 (76.3%)	0.619	0.736	1.66	1.67
	Hispanic	Below the Poverty Line	827 (17.8%)	13,070.6 (17.8%)	0	0.00264	0.0167	0.0167
		Not Below the Poverty Line	3,825 (82.2%)	60,412.5 (82.2%)	0	0.0151	0.06732	0.0674
	Asian	Below the Poverty Line	365 (11.1%)	5,885.18 (11.1%)	0	0.000240	0.0104	0.0105
		Not Below the Poverty Line	2,917 (88.9%)	46,904.3 (88.9%)	0	0.00290	0.0647	0.0652
	American Indian and Alaska Native	Below the Poverty Line	104 (21.6%)	1,686.93 (21.6%)	0	0.0000100	0.0163	0.0163
		Not Below the Poverty Line	380 (78.4%)	6,108.67 (78.4%)	0	0.000110	0.0414	0.0414
	Other	Below the Poverty Line	384 (15.7%)	6,195.62 (15.7%)	0	0.000130	0.00574	0.00588
		Not Below the Poverty Line	2,063 (84.3%)	33,195.11 (84.3%)	0	0.000550	0.0242	0.0248
Child Recreation	White	Below the Poverty Line	99,542 (11.8%)	1,498,230 (11.8%)_	0	0.0217	0.0300	0.0300
		Not Below the Poverty Line	745,153 (88.2%)	11,197,400 (88.2%)	0	0.207	0.572	0.572
	Black	Below the Poverty Line	55,555 (23.6%)	839,103 (23.7%)	0	0	0.00182	0.00182
		Not Below the Poverty Line	179,425 (76.4%)	2,707,350 (76.3%)	0	0	0.0633	0.0633
	Hispanic	Below the Poverty Line	12,052 (17.8%)	182,396 (17.8%)	0	0.0405	0.141	0.141
		Not Below the Poverty Line	55,754 (82.2%)	842,841 (82.2%)	0	0.136	0.750	0.750
	Asian	Below the Poverty Line	5,323 (11.1%)	80,818.1 (11.2%)	0	0.00812	0.0431	0.0431
		Not Below the Poverty Line	42,519 (88.9%)	643,641 (88.8%)	0	0.0570	0.649	0.649
	American Indian and Alaska Native	Below the Poverty Line	1,527 (21.6%)	23,156.0 (21.6%)	0	0.000910	0.00439	0.00439
		Not Below the Poverty Line	5,538 (78.4%)	83,839.5 (78.4%)	0	0.00147	0.0247	0.0247
	Other	Below the Poverty Line	5,604 (15.7%)	85,083.30 (15.7%)	0	0.00274	0.0196	0.0196
		Not Below the Poverty Line	30,065 (84.3%)	455,660.34 (84.3%)	0	0.00809	0.211	0.211

Notes:

(a) The exposed population for each race and ethnic group and income group is presented as the number of people exposed and the number of people exposed as a share of the total exposed population for the relevant income group in the cohort (in parentheses).

(b) The baseline total IQ points for each race and ethnic group and income group are presented as the total number of IQ points and the total number of IQ points as a share of the total number of IQ points for the relevant income group in the cohort (in parentheses).

Table E-2. Modeled Total IQ Points under the Baseline and Change in Avoided IQ Point Losses under the Regulatory Options among Child Subsistence and Recreational Fish Consumers Exposed to Mercury through Fish Consumption, by Income Group, Controlling for Race and Ethnicity

Cohort Group	Race/Ethnic Group	Income Group	Exposed Population (a)	Baseline Total IQ Points (b)	Option 1	Option 2	Option 3	Option 4
Child Subsistence	White	Below the Poverty Line	943 (12.8%)	5,900.27 (12.8%)	53.3	53.9	54.8	54.8
		Not Below the Poverty Line	6,451 (87.2%)	40,285.7 (87.2%)	311	315	321	322
	Black	Below the Poverty Line	492 (21.9%)	3,392.34 (21.9%)	25.3	25.5	26.2	26.2
		Note Below the Poverty Line	1,756 (78.1%)	12,104.5 (78.1%)	84.2	85.4	88.3	88.4
	Hispanic	Below the Poverty Line	113 (17.1%)	1,008.24 (17.1%)	6.56	6.73	7.19	7.19
		Not Below the Poverty Line	552 (82.9%)	4,899.34 (82.9%)	30.4	31.1	33.2	33.2
	Asian	Below the Poverty Line	63 (13.8%)	745.160 (13.8%)	4.77	4.88	5.12	5.13
		Not Below the Poverty Line	394 (86.2%)	4,662.71 (86.2%)	23.7	24.4	26.4	26.4
	American Indian and Alaska Native	Below the Poverty Line	12 (20.7%)	142.110 (20.7%)	0.580	0.590	0.760	0.760
		Not Below the Poverty Line	46 (79.3%)	543.670 (79.3%)	2.35	2.40	2.89	2.89
	Other	Below the Poverty Line	51 (15.9%)	608.470 (15.9%)	4.98	5.04	5.16	5.16
		Not Below the Poverty Line	271 (84.1%)	3,210.33 (84.1%)	22.4	22.8	23.4	23.5
Child Recreation	White	Below the Poverty Line	13,747 (12.8%)	30,320.9 (12.8%)	274	277	281	282
		Not Below the Poverty Line	94,016 (87.2%)	207,024 (87.2%)	1,600	1,620	1,650	1,650
	Black	Below the Poverty Line	7,171 (21.9%)	18,126.8 (21.9%)	135	136	140	140
		Not Below the Poverty Line	25,597 (78.1%)	64,679.7 (78.1%)	450	456	472	472
	Hispanic	Below the Poverty Line	1,656 (17.1%)	4,462.33 (17.1%)	29.1	29.8	31.8	31.8
		Not Below the Poverty Line	8,050 (82.9%)	21,683.9 (82.9%)	135	138	147	147
	Asian	Below the Poverty Line	918 (13.8%)	2,895.79 (13.8%)	18.5	19.0	19.9	19.9
		Not Below the Poverty Line	5,755 (86.2%)	18,119.9 (86.2%)	92.1	94.9	103	103
	American Indian and Alaska Native	Below the Poverty Line	176 (20.7%)	552.250 (20.7%)	2.25	2.29	2.96	2.97
		Not Below the Poverty Line	676 (79.3%)	2,112.79 (79.3%)	9.13	9.33	11.2	11.3
	Other	Below the Poverty Line	749 (15.9%)	2,364.58 (15.9%)	19.4	19.6	20.1	20.1
		Not Below the Poverty Line	3,961 (84.1%)	12,475.8 (84.1%)	87.1	88.4	91.1	91.1

Notes:
(a) The exposed population for each race and ethnic group and income group is presented as the number of people exposed and the number of people exposed as a share of the total exposed population for the relevant income group in the cohort (in parentheses).
(b) The baseline total IQ points for each race and ethnic group and income group are presented as the total number of IQ points and the total number of IQ points as a share of the total number of IQ points for the relevant income group in the cohort (in parentheses).

Table E-3. Modeled Total Cancer Cases under the Baseline and Change in Avoided Cancer Cases under the Regulatory Options among Adult Subsistence and Recreational Fish Consumers Exposed to Arsenic through Fish Consumption, by Income Group, Controlling for Race and Ethnicity

Cohort Group	Race/Ethnic Group	Income Group	Exposed Population	Total Cancer Cases	Option 1	Option 2	Option 3	Option 4
Adult Subsistence	White	Below the Poverty Line	82,136 (11.5%)	4.57 (11.2%)	0.000199	0.000202	0.000206	0.000206
		Not Below the Poverty Line	632,442 (88.5%)	36.1 (88.8%)	0.00115	0.00117	0.00121	0.00121
	Black	Below the Poverty Line	36,094 (21.1%)	2.12 (20.4%)	0.0000490	0.0000502	0.0000524	0.0000525
		Note Below the Poverty Line	134,987 (78.9%)	8.30 (79.6%)	0.000174	0.000179	0.000190	0.000190
	Hispanic	Below the Poverty Line	7,743 (16.2%)	0.583 (15.6%)	0.0000104	0.0000111	0.0000126	0.0000126
		Not Below the Poverty Line	40,196 (83.8%)	3.15 (84.4%)	0.0000533	0.0000565	0.0000635	0.0000636
	Asian	Below the Poverty Line	4,415 (11.6%)	0.45 (11.2%)	0.00000847	0.00000894	0.00000988	0.00000989
		Not Below the Poverty Line	33,570 (88.4%)	3.56 (88.8%)	0.0000530	0.0000569	0.0000652	0.0000653
	American Indian and Alaska Native	Below the Poverty Line	1,061 (19.8%)	0.107 (19.3%)	0.00000167	0.00000173	0.00000247	0.00000248
		Not Below the Poverty Line	4,291 (80.2%)	0.448 (80.7%)	0.00000653	0.00000688	0.00000905	0.00000906
	Other	Below the Poverty Line	3,921 (14.6%)	0.399 (14.1%)	0.0000125	0.0000128	0.0000133	0.0000133
		Not Below the Poverty Line	22,916 (85.4%)	2.42 (85.9%)	0.0000585	0.0000604	0.0000632	0.0000633
Adult Recreation	White	Below the Poverty Line	1,196,969 (11.5%)	23.5 (11.2%)	0.00102	0.00104	0.00106	0.00106
		Not Below the Poverty Line	9,216,588 (88.5%)	185 (88.8%)	0.00591	0.00604	0.00620	0.00621
	Black	Below the Poverty Line	526,000 (21.1%)	11.3 (20.4%)	0.000262	0.000268	0.000280	0.000281
		Not Below the Poverty Line	1,967,172 (78.9%)	44.3 (79.6%)	0.000928	0.000958	0.00101	0.00102
	Hispanic	Below the Poverty Line	112,845 (16.2%)	2.58 (15.6%)	0.0000461	0.0000490	0.0000556	0.0000557
		Not Below the Poverty Line	585,788 (83.8%)	14.0 (84.4%)	0.000236	0.000250	0.000281	0.000282
	Asian	Below the Poverty Line	64,346 (11.6%)	1.75 (11.2%)	0.0000329	0.0000348	0.0000384	0.0000384
		Not Below the Poverty Line	489,221 (88.4%)	13.9 (88.8%)	0.000206	0.000221	0.000253	0.000254
	American Indian and Alaska Native	Below the Poverty Line	15,468 (19.8%)	0.415 (19.3%)	0.00000649	0.00000673	0.00000961	0.00000962
		Not Below the Poverty Line	62,538 (80.2%)	1.74 (80.7%)	0.0000254	0.0000267	0.0000352	0.0000352
	Other	Below the Poverty Line	57,143 (14.6%)	1.55 (14.1%)	0.0000486	0.0000498	0.0000515	0.0000516
		Not Below the Poverty Line	333,968 (85.4%)	9.41 (85.9%)	0.000227	0.000235	0.000246	0.000246

Notes:

(a) The exposed population for each race and ethnic group and income group is presented as the number of people exposed and the number of people exposed as a share of the total exposed population for the relevant income group in the cohort (in parentheses).

(b) The baseline total cancer cases for each race and ethnic group and income group are presented as the total number of cancer cases and the total number of cancer cases as a share of the total number of cancer cases for the relevant income group in the cohort (in parentheses).