Environmental Injustice and COVID-19: Addressing the Link Between Pandemics and Pollution in Racial and Ethnic Minority Communities Under the Clean Air Act

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> "*Our responsibilities are to protect the health and environment of all Americans, including those historically marginalized, overburdened, underserved, and living with the legacy of structural racism.*"[1]

ABSTRACT

There are direct links between climate change, air pollution, and the spread and severity of respiratory pandemics. Individuals suffering from existing comorbidities associated with short-term and chronic exposure to harmful air pollutants face elevated risks for respiratory pathogens. The novel coronavirus SARS-CoV-2 (COVID-19) has spread throughout the world, but it has disparately impacted racial and ethnic communities exposed to elevated levels of air pollution.

Because climatic changes will worsen air quality, racial and ethnic communities that already suffer socioeconomic and health inequities face increasing health risks as climate change progresses. In its current form, the Clean Air Act is poorly suited to regulate the impacts of pollution on communities living closest to industrial facilities, major roadways, and other sources of pollution. Amending the Clean Air Act and developing policies to address near-source pollution can simultaneously address climate change while promoting environmental justice and health equity.

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1. E-mail from Michael S. Regan, EPA Administrator, to EPA Employees (Apr. 7, 2021), https://perma.cc/TZ6G-LUHF.

INTRODUCTION

Pollution affects everyone, but numerous studies have concluded that the burdens of pollution in society are not equitably distributed.[2] Regardless of the specific cause, throughout the country, racial and ethnic minorities continue to live

2. *See, e.g.*, U.S. GEN. ACCT. OFF., GAO/RCED-83-166, SITING OF HAZARDOUS WASTE LANDFILLS AND THEIR CORRELATION WITH RACIAL AND ECONOMIC STATUS OF SURROUNDING COMMUNITIES 1 (1983), https://perma.cc/4J8L-K294; Douglas L. Anderton et al., *Environmental Equity, The Demographics of Dumping*, 31 DEMOGRAPHY 229, 229 (1994); UNITED CHURCH OF CHRIST JUSTICE AND WITNESS MINISTRIES, TOXIC WASTE AND RACE AT TWENTY 1987-2007: GRASSROOTS STRUGGLES TO DISMANTLE ENVIRONMENTAL RACISM IN THE UNITED STATES 45 (March 2007) [hereinafter UCC, *Toxic Waste*] *available at* https://perma.cc/362T-MYTJ.

on the frontlines of chemical exposure.[3] Whether by conscious design, institutional neglect, or other factors, these communities have been forced to host heavily polluting facilities that other communities reject. In some areas, multiple industrial facilities are sited within the same community.[4] In other areas, historic state and national transportation policies routed major highways and roadways through low-income communities of color that continue to suffer from elevated exposure to harmful vehicle emissions.[5] These areas, colloquially referred to as "fenceline communities," "hot spots," or "sacrifice zones," expose vulnerable individuals to harmful air pollutants in quantities that may far exceed levels deemed safe for human health.

The novel coronavirus SARS-CoV-2 ("COVID-19") has impacted the entire world, but it has disparately impacted racial and ethnic minority communities whose members already suffer from respiratory co-morbidities associated with short-term and chronic exposure to harmful air pollutants.[6] Members of these communities often lack adequate access to healthcare, encounter language barriers, and live in substandard public housing complexes that place them at increased risk of contracting respiratory diseases such as COVID-19.[7]

The risks of harm from air pollution exposure increase as the ambient temperature increases.[8] Changes in temperature, humidity, precipitation, and other meteorological factors will alter the concentration and broaden the distribution of air pollutants in ways that increase health risks.[9] Prolonged exposure to extreme heat can also exacerbate preexisting chronic conditions, including respiratory and

3. In his book "*Sacrifice Zones: The Front Lines of Toxic Chemical Exposure in the United States*," researcher Steve Learner provides case studies on a dozen environmental justice communities scattered throughout the United States. He opined: "What the residents profiled here have in common is that they all live on the frontlines of toxic chemical exposure in the United States. They inhabit low-income 'sacrifice zones' where hundreds of thousands of residents are exposed to disproportionately elevated levels of hazardous chemicals. They reside in semi-industrial areas largely populated by African Americans, Latinos and Native Americans, and low-income whites where a dangerous and sometimes lethal brand of racial and economic discrimination persists." *See* STEVE LERNER, SACRIFICE ZONES: THE FRONT LINES OF TOXIC CHEMICAL EXPOSURE IN THE UNITED STATES 2 (2012).

4. For example, the community of Altgeld Gardens in Chicago is surrounded by 50 landfills and 382 industrial facilities. EPA, *Environmental Justice Atlas: Chicago's Toxic Doughnut, USA*, https://perma.cc/LQ38-NWBR (last updated May 7, 2015).

5. Deborah N. Archer, *Transportation Policy and the Underdevelopment of Black Communities*, 106 IOWA L. REV. 2125, 2132-33 (2021).

6. *Health Equity Considerations and Racial and Ethnic Minority Groups*, CDC (July 1, 2022), https://perma.cc/TBP8-RPW9; CDC, *Risk of Exposure to COVID-19: Racial and Ethnic Health Disparities*, (Dec. 10, 2020), https://perma.cc/GTW4-EQ38.

7. *Risk of Exposure to COVID-19: Racial and Ethnic Health Disparities*, CDC (Dec. 10, 2020), https://perma.cc/GTW4-EQ38.

8. *See e.g.*, Marianthi-Anna Kioumourtzoglou et al., *PM2.5 and Mortality in 207 US Cities: Modification by Temperature and City Characteristics*, 27 EPIDEMIOLOGY 221, 226 (2016).

9. EPA, CLIMATE CHANGE AND SOCIAL VULNERABILITY IN THE UNITED STATES 20 (Sept. 2021), https://perma.cc/QY6X-UT2N.

cardiovascular diseases.[10] In an age of climate change, these facts portend a bleak future for racial and ethnic minority communities already suffering from elevated exposure to air pollution. Individuals living in these communities may be least able to anticipate, cope with, and recover from the adverse impacts of climate-driven changes in air pollution, extreme heat waves, and other factors.[11] These realities have elevated social and racial injustice and health inequity to the forefront of public health debate.[12]

Recognizing these connected problems, President Biden has linked addressing persistent racial and social injustice to his broader, government-wide plan to combat climate change.[13] The ambitious plan is laudable, but to effect meaningful change the administration must address current regulatory gaps under the Clean Air Act that place certain communities at elevated risk of exposure to harmful pollutants. Part I of this article explains the current regulatory framework for controlling the harmful emission of pollutants under the Clean Air Act. Part II examines health risks associated with exposure to air pollution, with emphasis on the elevated risks faced by racial and ethnic minorities living near sources of pollution. Part III explores the links between air pollution-related co-morbidities and COVID-19 health outcomes in racial and ethnic minority communities and examines how climatic change will likely exacerbate health risks associated with respiratory diseases in those communities. Part IV examines historical practices that have left behind a legacy of pollution impacts that burden racial and ethnic minority communities throughout the nation. Part V provides recommendations to address the harms of near-source pollution on vulnerable populations.

I. REGULATING HARMFUL EMISSIONS UNDER THE CLEAN AIR ACT

Dense, visible smog in major city centers and overall poor air quality throughout the United States in the late 1960s prompted Congress to promulgate more stringent air quality legislation.[14] The Clean Air Act ("CAA") was enacted "to speed up, expand, and intensify the war against air pollution in the United States with a view to assuring that the air we breathe throughout the Nation is wholesome once again."[15] Congress intended to protect public health and welfare from different types of harmful air pollutants emitted by a diverse array of pollution sources.[16] Starting with the Clean Air Act Amendments of 1970 and continuing

10. *Temperature-related Death and Illness*, NAT'L INST. OF HEALTH: NAT'L INST. OF ENV'TL HEALTH SCI., https://perma.cc/8GSM-2C2W (last updated June 22, 2022).

11. EPA, *supra* note 9; Kimberly Thomas et al., *Explaining Differential Vulnerability to Climate Change: A Social Science Review*, 10 WILEY INTERDISCIPLINARY REV. CLIMATE CHANGE 1, 2 (2019).

12. *Id.*

13. Exec. Order No. 14008, 86 Fed. Reg. 7619 (Feb. 1, 2021).

14. Arthur C. Stern, *History of Air Pollution Legislation in the United States*, 32 J. AIR POLLUTION CONTROL ASSOC. 44 (Mar. 12, 2012).

15. H.R. REP. NO. 91-1146, at 1 (1970), *as reprinted in* 1970 U.S.C.C.A.N. 5356, 5356.

16. 42 U.S.C. §§ 7401 et seq. (1970).

with amendments in 1977 and 1990 to strengthen and expand the law, Congress has made air pollution control a national priority.[17]

The EPA groups air pollutants into four categories: area, biogenic, mobile, and point sources of pollution.[18] Area sources include sources of air pollution spread over large areas without a specific location of origin, such as emissions from livestock, fertilizer use, or dust released from unpaved roads.[19] Emissions from these sources are estimated and are included in pollution modeling for compliance purposes.[20] Biogenic sources are natural sources of pollutants, such as volatile organic compound ("VOC") emissions from vegetation and nitric oxide ("NOx") emissions from soils.[21] The EPA uses a Biogenic Emission Inventory System ("BEIS") to model the contribution of these emissions to pollution inventories.[22] Mobile sources include on-road vehicles, nonroad vehicles, and other small engines that release pollution into the air.[23] Point sources of air pollution are stationary sources, such as electric power plants, readily identifiable by location that release pollutants into the air.[24] These mobile and point sources of air pollution are subject to comprehensive regulation under both state and federal law.

The Clean Air Act was enacted to protect human health and the environment from harmful emissions that pollute outdoor air.[25] Its purpose is to achieve safe and acceptable air quality for the entire nation.[26] This goal is primarily achieved through the creation and enforcement of National Ambient Air Quality Standards ("NAAQS") and the regulation of harmful pollutants released from mobile or stationary sources.[27]

A. NAAQS: CONTROLLING CRITERIA POLLUTANTS UNDER THE CAA

Under the Clean Air Act, the EPA is charged with identifying and regulating air pollutants which "cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare" and which originate from "numerous or diverse mobile or stationary sources."[28] Once these so called

17. Paul G. Rogers, *EPA History: The Clean Air Act of 1970*, EPA JOURNAL (1990), https://perma.cc/RXE9-G48M.

18. *Air Pollution Emissions Overview*, EPA, https://perma.cc/FQ2Z-YEEF (last updated June 8, 2016).

19. *Pollutants and Sources*, EPA, https://perma.cc/RU29-TYB3 (last updated Sep. 26, 2018).

20. *Air Pollution Emissions*, EPA, https://perma.cc/3PM9-AKAU (last updated June 8, 2016).

21. *Biogenic Emission Inventory System (BEIS)*, EPA, https://perma.cc/7VKM-YK5H (last updated Dec. 16, 2021)

22. *Id.*

23. *Air Pollution Emissions Overview*, EPA, https://perma.cc/FQ2Z-YEEF (last updated June 8, 2016).

24. *Id.*

25. 42 U.S.C. § 7401.

26. Whitman v. American Trucking Assns., Inc., 531 U. S. 457, 465 (2001) (noting that the NAAQS represent "the maximum airborne concentration of [the] pollutant that the public health can tolerate").

27. 42 U.S.C. §§ 7408(a)(1), 7412.

28. 42 U.S.C. § 7408(a)(1).

"criteria pollutants" have been identified, the EPA is required to establish national standards for these harmful pollutants, "the attainment and maintenance of which . . . are requisite to protect the public health" with "an adequate margin of safety," and "to protect the public welfare from any known or anticipated adverse effects."[29] The Act requires the EPA to prescribe primary and secondary standards for each pollutant.[30] Primary standards must be sufficient to protect the public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly.[31] Secondary standards must be sufficient to protect the public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.[32] Consistent with these objectives, the EPA has established NAAQS for six principal pollutants ("criteria" air pollutants), which are ubiquitous and harmful to public health and the environment.[33] These include sulfur dioxide (SO_2),[34] nitrogen oxide (NOx),[35] ozone (O_3),[36] carbon monoxide (CO),[37] lead (Pb),[38] and two forms of particulate matter ($PM_{2.5}$ and PM_{10}).[39] These national standards are designed to improve the quality of the air throughout the nation by setting limits on the maximum concentration of criteria pollutants in ambient air over large geographic areas.[40] Compliance with these national standards suggests that the air quality is sufficiently protective of public health and the environment. All NAAQS, and the science supporting them, must be reviewed every five years to determine if more stringent standards are warranted.[41]

States are primarily responsible for developing emission reduction strategies, plans, and programs for controlling the emission of criteria pollutants within their borders.[42] Each state is required to submit a State Implementation Plan ("SIP") to the EPA for approval that outlines steps it will take to assure the state attains and/or maintains the federally mandated level of overall air quality under the NAAQS.[43] If the EPA rejects the SIP, the state may revise it or risk the EPA imposing its own federal implementation plan on the state.[44] Any area within a

29. *Id.* § 7409(a)–(b).
30. *Id.* § 7409.
31. *Id.* § 7409 (b)(1); *see also* EPA, *NAAQS Table* (2022), https://perma.cc/G2NG-PF2N.
32. *Id.* § 7409(b)(1).
33. 42 U.S.C. §§ 7407–7410; 40 C.F.R. pt. 50 (2022).
34. 40 C.F.R. pts. 50.4–50.5 (2022).
35. *Id.* pt. 50.11.
36. *Id.* pts. 50.9–50.10.
37. *Id.* pt. 50.8.
38. *Id.* pt. 50.12.
39. *Id.* pts. 50.6–50.7.
40. 42 U.S.C. §7409.
41. *Id.* § 7409(d)(1). The EPA must revise the standards "in the same manner as promulgated." *See* 42 U.S.C. § 7409(b)(1).
42. *Id.* § 7407.
43. *Id.* § 7410(a); Train v. Natural Resources Defense Council, Inc., 421 U.S. 60, 65 (1975).
44. 42 U.S.C. § 7410(c).

state that fails to meet the NAAQS for a criteria pollutant is deemed a "nonattainment area" for that pollutant.[45] For those areas, states must clarify in their SIPs how they plan to address the problem to bring the area into attainment.[46] If the plan is not approved, the EPA is required to promulgate a federal implementation plan that imposes additional, stricter regulatory measures.[47] If the EPA fails to take this non-discretionary action, the CAA permits citizens to seek a court order to compel compliance with the Act.[48]

The concentration of criteria pollutants in ambient air is measured primarily through a network of monitoring stations strategically located within air quality control regions ("AQCRs") to measure regional air quality.[49] Each state is required to create an air quality surveillance system that consists of a network of state or local air monitoring stations ("SLAMS") comprising one or more air monitors.[50] These networks are subject to the approval of the EPA Regional Administrator.[51] Data obtained from these monitors is used to distinguish between areas where criteria pollutant levels violate the NAAQS and areas where they do not.[52] States are required to increase efforts to reduce pollution in areas that exceed national standards.[53]

The placement of monitoring stations is largely based on population density and emitting sources, but siting decisions are also influenced by politics.[54] By design, monitoring networks provide data on overall ambient air quality within different air control regions of the state to ensure compliance with the NAAQS, but they provide limited localized pollution data. In Florida, for example, state regulators gather air quality data from a network of 177 monitors at 90 sites located throughout the state that encompasses 65,758 square miles.[55] Most of the monitors are placed in large metropolitan areas to record area-wide concentrations of criteria pollutants or other pollutants of concern.[56]

This basic regulatory scheme for criteria pollutants has resulted in significant reductions in ambient concentrations of those pollutants and concomitant

45. *Id.* §7407.
46. *Id.* § 7410 (a).
47. *Id.* § 7410(c).
48. *Id.* § 7604(a)(2).
49. *Frequently Asked Questions about Air Emissions Monitoring*, EPA, https://perma.cc/5UVL-2CR8 (last updated Aug. 11, 2022).
50. 40 C.F.R. § 58.10 (2022).
51. *Id.* § 58.10(a)(2).
52. *Id.*
53. *Id.* The EPA requires States to develop an annual Air Monitoring Network Plan and to include in the plan its strategy for addressing areas that do not meet the NAAQS. *See* 40 C.F.R. § 58 (2022).
54. *See, e.g.*, 40 C.F.R. § 58.10(a)(8)(ii) (2022) (requiring a "state plan for establishing near-road PM2.5 monitoring sites in CBSAs having 1 million or more persons, but less than 2.5 million persons.").
55. FLA. DEP'T ENV'T PROT., ANNUAL AMBIENT AIR MONITORING NETWORK PLAN 1 (2021), https://perma.cc/GK9Z-2V3V.
56. *Id.*

improvements in overall air quality nationwide.[57] The monitoring structure provides useful air quality data at the regional level and data on certain individual sources of pollution, but it does not provide meaningful insight into local air quality in communities located close to industrial areas or near highways and roadways. Moreover, regulators often use faulty factors to estimate emission quantities when developing control strategies and setting emissions limits in permits for stationary sources.[58] The EPA has acknowledged that this approach can be inaccurate and significantly underestimate the amount of pollution released from a source.[59]

The inability to accurately measure near-source pollution allows for local ambient concentrations of criteria pollutants to far exceed federal NAAQS standards even where the state meets the national standards. Because compliance with NAAQS is based on ambient air quality measured over large geographic areas, the current structure masks localized pollution "hotspots" that can pose significant health and environmental risks that are not accounted for under the CAA.[60] Moreover, there is some evidence that regulators tasked with designing their state's monitoring networks for ambient pollution strategically avoid pollution hotspots when siting monitors to ensure compliance with national standards.[61]

In addition to the NAAQS, the Clean Air Act also created federal standards for mobile sources of air pollution and their fuels and established limits for other hazardous air pollutants emitted from stationary sources.

B. CONTROLLING MOBILE SOURCE EMISSIONS

Mobile sources of pollution are ubiquitous and contribute significantly to poor air quality at the state, national, and international levels, but the health impacts of mobile source emissions are greatest near roads, airports, ports, railyards, and other areas of high traffic.[62] With approximately 45 million Americans living, working, or attending school within 300 feet of a major road, airport, or railroad, the health risks of mobile-source air toxics are significant.[63]

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57. *See Progress Cleaning the Air and Improving People's Health*, EPA, https://perma.cc/XLJ3-9A9T (last updated Mar. 9, 2022).

58. *See Basic Information of Air Emissions Factors and Quantification*, EPA, https://perma.cc/WYR8-9XT4 (last updated Jan. 4, 2022) ("An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant."); Ann E. Carlson, *The Clean Air Act's Blind Spot: Microclimates and Hotspot Pollution*, 65 UCLA L. REV. 1036, 1041 (2018).

59. *See, e.g.*, Technical Memorandum from Brenda Shine, EPA, to EPA Docket No. EPA-HQ-OAR-2003-0146, Potential Low Bias of Reported VOC Emissions from the Petroleum Refining Industry (July 27, 2007), https://perma.cc/2U2R-X7VX.

60. For an in-depth discussion of the problems of CAA hotspots, *see* Carlson, *supra* note 58.

61. Corbett Grainger & Andrew Schreiber, *Discrimination in Ambient Air Pollution Monitoring?*, 109 AM. ECON. ASS'N PAPERS & PROC. 277, 277 (2019).

62. EPA, EPA-420-F-14-044, NEAR ROADWAY AIR POLLUTION AND HEALTH: FREQUENTLY ASKED QUESTIONS 1 (2014), https://perma.cc/4JMG-S897.

63. *Id.* at 3.

Automobiles release numerous criteria pollutants, including particulate matter ($PM_{2.5}$; PM_{10}), nitrogen oxides (NOx), carbon monoxide (CO) and sulfur dioxide (SO_2), along with other non-criteria pollutants such as volatile organic compounds (VOCs) and greenhouse gases.[64] The EPA regulates the release of pollutants from mobile sources indirectly through the NAAQS and directly through other regulations. Direct regulation of air pollution from mobile sources is achieved by regulating the composition of fuels and fuel additives and by regulating emission-control components for on-road and nonroad vehicles engines.[65] The Clean Air Act Amendments of 1990 established more stringent pollution standards for emissions from mobile sources.[66] No state, with the exception of California, may set its own motor vehicle emission standards.[67] The EPA has phased in progressively more stringent emission standards to reduce the impacts of motor vehicles on air quality and public health.[68]

In 1975, acting in response to the 1973-74 Arab oil embargo, Congress established Corporate Average Fuel Economy ("CAFE") standards for passenger cars and light trucks.[69] These standards are designed to reduce energy consumption by increasing the fuel economy of cars and light trucks.[70] CAFE standards represent fleet-wide fuel economy averages, reflected by required miles per gallon ("mpg") goals, that each automaker must achieve annually for its car and truck fleet.[71] The National Highway Traffic Safety Administration ("NHTSA") recently amended the standards for passenger cars and light trucks for model year 2024-2026 to further improve energy conservation.[72]

C. CONTROL OF STATIONARY SOURCE EMISSIONS

Stationary sources release a wide variety of harmful pollutants into the air. States, through their approved State Implementation Plans, identify those sources that must reduce emissions to meet federals standards. Major stationary sources are required to install pollution control equipment and to meet specific emissions limitations listed in state operating permits.[73] To control emissions of criteria

64. *Id.* at 1.

65. *See generally All EPA Emission Standards*, EPA, https://perma.cc/4392-YC2A (last updated Mar. 21, 2022).

66. 42 U.S.C. §7521; *see* Clean Air Act, 42 U.S.C. § 7401 et seq.

67. NATT'L RSCH. COUNCIL, AIR QUALITY MANAGEMENT IN THE UNITED STATES (2004); 42 U.S.C. § 7542(b)(1).

68. *See Basic Information about the Emission Standards Reference Guide for On-road and Nonroad Vehicles and Engines, Overview of Mobile Sources*, EPA, https://perma.cc/P95C-LTF7 (last updated June 27, 2022).

69. Energy Policy and Conservation Act, Pub. L. No. 94-163, §§ 501–12, 89 Stat. 871, 901–16 (1975).

70. *Id.*

71. *Id.*

72. Corporate Average Fuel Economy Standards for Model Years 2024-2026 Passenger Cars and Light Trucks, 87 Fed. Reg. 25,710 (May 2, 2022) (to be codified at 49 C.F.R. pts. 531, 533, 536, 537).

73. 40 C.F.R. § 70.1 (2022); 40 C.F.R. § 70.5 (2022).

pollutants, states impose limitations through permit conditions.[74] To directly control the emissions of non-criteria pollutants from stationary sources, the EPA utilizes two other performance standards: Hazardous Air Pollutant ("HAP") standards and New Source Performance Standards.

1. Control of Hazardous Air Pollutants

In addition to releasing one or more criteria pollutants, stationary sources release a variety of other hazardous air pollutants ("HAPs" or "Air Toxics"). These air toxics, such as dioxin, asbestos, toluene, and mercury are known to cause cancer or other serious health and environmental effects through exposure.[75] The CAA established federal regulations for those toxic air pollutants, other than those already covered by a NAAQS, that present "a threat of adverse human health effects," including substances known or anticipated to be "carcinogenic, mutagenic, teratogenic, neurotoxic," or otherwise "acutely or chronically toxic."[76] Currently, the EPA regulates 187 toxic air pollutants.[77]

To address air toxics from stationary sources, the CAA required development of risk-based National Emission Standards for Hazardous Air Pollutants ("NESHAPs").[78] The EPA Administrator was directed to set emission standards "at the level which in his judgment provides an ample margin of safety to protect the public health from such hazardous air pollutants."[79] These NESHAPs apply to all new or modified stationary sources of air toxics.[80]

The EPA regulates air toxics from major sources in two phases. First, the EPA seeks to control emissions within a major source category by establishing maximum achievable control technology ("MACT") standards for the industry.[81] Second, the EPA evaluates the effectiveness of the MACT control strategy.[82] If application of MACT standards to a source is not sufficiently protective of public health, the EPA is required to promulgate health-based standards for that source to further reduce emissions.[83] The CAA requires the EPA to develop additional strategies to reduce air toxics in urban areas.[84] To date, the EPA has identified

74. *See Air Emissions Monitoring for Permits*, EPA, https://perma.cc/C727-3YRE (last updated Dec. 16, 2021).

75. *See, e.g.*, *Health and Environmental Effects of Hazardous Air Pollutants*, EPA, https://perma.cc/F38H-4EU9 (last updated Feb. 3, 2020).

76. 42. U.S.C. §7412(b)(2).

77. *What Are Hazardous Air Pollutants*, EPA, https://perma.cc/2XM7-FXVU (last updated Jan. 5, 2022).

78. 42 U.S.C. § 7412.

79. *Id.* § 7412(d)(4).

80. *Id.*

81. *Id.*

82. *Id.*

83. EPA, EPA-453/R-99-001, RESIDUAL RISK REPORT TO CONGRESS (1999); 42 U.S.C. § 7412(f)(2)(A).

84. 42 U.S.C. § 7412.

thirty air toxics posing the greatest threat to public health in urban areas and has subjected sources to additional regulation.[85]

2. New Source Performance Standards

The Clean Air Act also directs EPA to list "categories of stationary sources" that it determines "causes, or contribute significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare."[86] The EPA is required to establish for each category federal standards of performance for new sources.[87] This directs the EPA to (1) determine the best system of emission reduction which has been adequately demonstrated for the category, (2) determine the degree of emission limitation achievable through the application of that system, and then (3) impose an emissions limit on new stationary sources that reflects that amount.[88] Once the EPA sets the standard for a new source, it is required to address emissions of that same pollutant from existing sources if that pollutant is not already regulated under the NAAQS or HAP programs.[89]

II. INEQUITABLE HEALTH RISKS FROM AIR POLLUTION

Since the enactment of the Clean Air Act in 1970, the combined emissions of some of the most common harmful pollutants has declined by almost eighty percent.[90] Notwithstanding this significant progress, air pollution continues to threaten human health.[91] Nearly half of the population of the United States breathes unhealthy air, and this exposure is directly linked to numerous health issues, including mortality.[92] Exposure to emissions from mobile and stationary sources of pollution are particularly problematic.

Despite efforts to reduce mobile source emissions, the predominantly fossil fuel-based transportation industry continues to grow and represents the largest

85. *Id.; see also, Urban Air Toxic Pollutants*, EPA, https://perma.cc/7V4R-87LD (last updated Feb. 7, 2020).

86. 42 U.S.C. §7411(b)(1)(A).

87. *Id.* §7411(b)(1)(B).

88. *Id.* §7411(a)(1). ("The term 'standard of performance' means a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.").

89. West Virginia v. EPA, 597 U.S. __ (2022); 42 U.S.C. § 7411(d)(1).

90. *See Progress Cleaning the Air and Improving People's Health*, EPA, https://perma.cc/6BXX-SH5L (last updated Mar. 9, 2022) (noting that the combined emissions of six common pollutants (PM2.5 and PM10, SO2, NOx, VOCs, CO and Pb) dropped by 78 percent between 1970 and 2020).

91. *See, e.g.*, *Mobile-Source Air Toxics*, U.N. ECON. COMM'N FOR EUR. UNION, https://perma.cc/5KJW-RW36 (last visited Oct. 27, 2022) (describing the global effects of air pollution which accounts for an estimated 7 million deaths per year).

92. AM. LUNG ASS'N, STATE OF THE AIR (2021), https://perma.cc/THQ5-NE34.

source of air pollution in the United States.[93] The current regulatory framework for stationary sources is hindered in ways that permit the unintended release of significant quantities of harmful air pollutants. The EPA relies heavily on emission factors to develop emission inventories for both criteria and air toxics released from stationary sources, and those factors are used in decisions regarding facility permitting, development of control strategies, and compliance and enforcement decisions.[94] Yet, the EPA has acknowledged that many emissions factors for stationary sources are improper or inaccurate and result "in the release of significant amounts of unidentified and uncontrolled emissions."[95] Further, existing regulations under the CAA permit facilities to emit quantities of harmful pollutants during startup, shutdown, and malfunction/maintenance ("SSM") events that far exceed that allowed under their permits during normal operations.[96] In most cases these emissions are not considered in control strategies.[97]

Air pollution from mobile and stationary sources impact all Americans, but individuals living closest to roadways, railways, ports, and other pollution emitting facilities face greater risks of harm.[98] Exposure to elevated levels of harmful air pollutants is linked to many diseases including asthma, chronic obstructive pulmonary disease, coronary heart failure, diabetes, dysrhythmia, hypertension, myocardial infarction, respiratory conditions, pneumonia, and upper respiratory infection.[99] Studies reveal that several types of pollutants regulated under the CAA—particulate matter ($PM_{2.5}$; PM_{10}), nitrogen dioxide (NOx), ozone (O_3), and volatile organic compounds (VOCs)—are particularly problematic and continue to pose significant health risks for those living closest to the sources of pollution.[100] The differential "pollution burden" cuts across racial and ethnic lines.[101]

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93. *See* U.S. ENERGY INFORMATION ADMINISTRATION, DOE/EIA-0035(2022/10), MONTHLY ENERGY REVIEW (2022), https://perma.cc/J76S-E54B; *Carbon Pollution from Transportation*, EPA, https://perma.cc/5KBD-QJJ2 (last updated May 19, 2022).

94. EPA, REPORT NO. 2006-P-00017, EPA CAN IMPROVE EMISSIONS FACTORS DEVELOPMENT AND MANAGEMENT 1, 4 (2006), https://perma.cc/ZB7X-3FUE.

95. *Id*. at 8.

96. *See* Nikolaos Zirogiannis et al., *Understanding Excess Emissions from Industrial Facilities: Evidence from Texas*, 52 ENV. SCI. TECH 2482 (2018); s*ee also* Earthjustice, Petition for Rulemaking to Eliminate Startup, Shutdown, and Malfunction Exemptions in Clean Air Act Section 111 Regulations (Sept. 13, 2022), https://perma.cc/F55U-D9LD.

97. Although the CAA does not require community ambient air or continuous fenceline emissions monitoring for most facilities, the EPA has required the petroleum industry to conduct fenceline monitoring for one air toxic—benzene. *See* 40 C.F.R. § 63.658 (2018). It is unclear whether the EPA will expand this requirement to other industries and to other air toxics.

98. *See e,g, Living Near Highways and Air Pollution,* AM. LUNG ASS'N (2021), https://perma.cc/2TB5-NY83; Jean D. Brender et al., *Residential Proximity to Environmental Hazards and Adverse Health Outcomes*, 101 AM. J. PUB. HEALTH S37 (2011).

99. *See e.g*., WORLD HEALTH ORG., HEALTH EFFECTS OF PARTICULATE MATTER 6 (2013).

100. *NAAQS Table*, *supra* note 31.

101. Nicole Rura, *Racial, Ethnic Minorities and Low-income Groups in U.S. Exposed to Higher Levels of Air Pollution*, HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH (Jan. 12, 2022), https://perma.cc/53TK-HUVE.

A. PARTICULATE MATTER (PM)

Particulate matter ("PM") refers to the mixture of solid particles and liquid droplets, man-made and natural, suspended in air.[102] The most dangerous form of particle pollution is commonly referred to as $PM_{2.5}$.[103] These fine particles are particularly dangerous because they are small enough to travel deep into the lungs, bypassing many of the lungs' natural defenses, to obstruct and kill tiny single-cell alveoli essential to the exchange of oxygen and carbon dioxide within the respiratory system.[104] These particles also often have other toxic substances (lead, sulfates, and various metals) adsorbed to their surface.[105] Exposure to $PM_{2.5}$ has been linked to many health problems, from increased asthma attacks to death.[106] Globally, more than ten million premature deaths annually are attributable to the fossil-fuel component of $PM_{2.5}$.[107]

Studies show that the risks associated with $PM_{2.5}$ exposure is inequitably distributed among demographic groups due to differences in pollution concentrations at different locations.[108] Blacks, Asians, Hispanics, Latinos, and low-income populations suffer from greater exposure to dangerous fine particulate air pollution than other groups.[109] Racial and ethnic minorities living in fenceline communities or near pollution hotspots with elevated levels of $PM_{2.5}$ face increased health risks.[110] A 2011 study found that Blacks and Hispanics were consistently overrepresented in communities with the poorest air quality for $PM_{2.5}$.[111] The study also showed that the percentage of residents living in poverty was positively associated with the probability of a county having the worst air quality for both annual and daily $PM_{2.5}$.[112] A 2018 study showed that Black and Hispanic Americans were exposed to 1.54 times and 1.28 times respectively, more particulate matter than the population at large.[113] A 2019 study examining the disparity between the pollution that people cause and the pollution to which

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102. *What is PM, and How Does it Get into the Air?*, EPA, https://perma.cc/L79Z-ALGY (last updated July 18, 2022).

103. *Id.*

104. Marie Lynn Miranda et al., *Making the Environmental Justice Grade: The Relative Burden of Air Pollution Exposure in the United States*, 8 INT J. ENV'T RSCH. PUB. HEALTH 1755, 1755–56 (2011).

105. *Id.*

106. Angelica I. Tiotiu et al., *Impact of Air Pollution on Asthma Outcomes*, 17 INT. J. ENV'T RSCH. PUB. HEALTH 6212, 6212 (2020).

107. Karn Vohra et al., *Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem*, 195 ENV'T RSCH. 110754, 110754 (2021).

108. Anjum Hajat et al., *Socioeconomic Disparities and Air Pollution Exposure: A Global Review*, 2 CURRENT ENV'T HEALTH REP. 440, 440 (2015).

109. Rura, *supra* note 101.

110. Cheryl Katz, *People in Poor Neighborhoods Breathe More Hazardous Particles,* SCI. AM. (Nov. 1, 2012), https://perma.cc/ZBB9-RKLP.

111. Miranda, *supra* note 104, at 1768.

112. *Id.*

113. Ihab Mikati et al., *Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status*, 108 AM. J. PUB. HEALTH 480, 480 (2018).

they are exposed revealed that $PM_{2.5}$ exposure is disproportionately caused by consumption of goods and services mainly by the non-Hispanic White majority, but disproportionately inhaled by Black and Hispanic minorities.[114] The study showed that non-Hispanic Whites experience approximately seventeen percent less air pollution exposure than is caused by their consumption while Blacks and Hispanics bear a "pollution burden" of fifty-six percent and sixty-three percent excess exposure, respectively, relative to the exposure caused by their consumption.[115] More recently, a 2021 study confirmed that racial and ethnic minorities in the United States continue to be exposed to disproportionately high levels of $PM_{2.5}$.[116]

Epidemiological studies have shown that exposure to $PM_{2.5}$ increases the incidence asthma and results in a significant increase in the incidence of hospital visits and deaths due to acute asthma attacks.[117] Blacks and American Indian/Alaska Natives have the highest current asthma rates compared to other races and ethnicities, and asthma rates are significantly higher for individuals living below the poverty threshold. [118]

B. NITROGEN DIOXIDE (NO_2)

Nitrogen Dioxide ("NO_2") is a dangerous pollutant released into the atmosphere primarily through the combustion of fossil fuels by mobile sources and the burning of vegetation.[119] Inhalation of high concentrations of NO_2 can aggravate respiratory diseases, while chronic exposure has been linked to the development of asthma, hypertension, diabetes, heart disease, and cardiovascular diseases, and to the increased susceptibility to respiratory infections and lung cancer.[120]

Although NO_2 emissions have declined significantly across the nation, racial and ethnic minority communities still suffer disproportionate impacts from NO_2. A 2014 study revealed non-White Americans experience thirty-eight percent higher NO_2 concentrations than White Americans, in part because these communities are situated closer to major roads, industrial plants, and other sources of the pollutant.[121] The study also showed that people living below the poverty level are exposed to higher concentrations of NO_2 than people living above the poverty

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114. Christopher W. Tessum et al., *Inequity in Consumption of Goods and Services Adds to Racial–Ethnic Disparities in Air Pollution Exposure*, 116 PROC. NAT'L ACAD. SCI. 6001, 6001 (2019).

115. *Id.*

116. Christopher W. Tessum et. al., *PM2.5 Polluters Disproportionately and Systemically Affect People of Color in the United States*, 7 SCI. ADVANCES 1 (2021).

117. Jingjing Luo et al., *The Correlation of PM2.5 Exposure with Acute Attack and Steroid Sensitivity in Asthma*, BIOMEDICAL RSCH. INT'L Aug. 2022, at 1.

118. *Current Asthma Demographics*, AM. LUNG ASS'N, https://perma.cc/QN6N-9BNH (last updated July 6, 2020).

119. *Basic Information about NO2*, EPA, https://perma.cc/M2CS-7YQ8. (last updated Aug. 2, 2022).

120. *Id.*

121. Lara P. Clark et al., *National Patterns in Environmental Injustice and Inequality: Outdoor NO2 Air Pollution in the United States,* 9 PLOS ONE 1, 1 (2014).

line, and that exposures are higher for lower-income non-Whites than for higher-income Whites.[122] The study authors noted that the difference in exposures accounted for roughly an additional 7,000 heart-disease-related deaths in non-White communities per year.[123] Nationally, the percent of racial and ethnic minorities living under the federal poverty line is far greater than for non-Hispanic White Americans.[124]

C. GROUND-LEVEL OZONE (O_3)

Ground-level ozone (O_3) is created when oxides of nitrogen (NOx) and volatile organic compounds (VOCs) emitted by cars, chemical plants, and other sources chemically react in the presence of sunlight.[125] As temperature increases, ozone production also increases, and concentrations may exceed safe levels.[126] Breathing ground-level ozone at concentrations above safe levels can cause a range of harmful respiratory health effects, including asthma and emphysema.[127]

A 2011 study revealed that non-Hispanic Blacks were overrepresented in counties with the worst ozone pollution.[128] More recently, a 2022 report from the American Lung Association revealed that more than forty-one percent of Americans live in counties with unhealthy levels of ozone or particle pollution and that people of color are sixty-one percent more likely than White people to live in a county with a failing grade for at least one of these pollutants.[129] Collectively, the study found that people of color are over three times more likely than White people to be breathing the most polluted air.[130]

D. VOCS AND OTHER AIR TOXICS

Industrial facilities and mobile sources generate a myriad of hazardous air pollutants which place nearby communities at risk.[131] Exposure to these air toxics can cause severe health problems, including cancer, birth defects, lung diseases, kidney disorders, liver problems, bone marrow diseases, and damage to immune and nervous systems, among others.[132] These impacts may result from low level

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122. *Id*. at 2.

123. *Id*. at 1.

124. John Creamer, *Inequalities Persist Despite Decline in Poverty For All Major Race and Hispanic Origin Groups*, U.S. CENSUS BUREAU (Sept. 15, 2020), https://perma.cc/P4C4-2AGT.

125. *Ground-level Ozone Basics*, EPA, https://perma.cc/3X7D-Q6AF (last updated June 14, 2022).

126. *Id*.

127. *2015 Revision to 2008 Ozone National Ambient Air Quality Standards (NAAQS) Related Documents*, EPA, https://perma.cc/KK3A-ZFM6. (last updated Aug. 3, 2022).

128. Miranda, *supra* note 104, at 1764–65.

129. *State of the Air 2022: Key Findings*, AM. LUNG ASSOC. (2022), https://perma.cc/C88J-PBZE.

130. *Id*.

131. *Hazardous Air Pollutants: Sources and Exposure*, EPA, https://perma.cc/PD3T-R2PR (last updated Feb. 3, 2020).

132. *See Toxic Substance Portal, Health Effects of Exposure to Substances,* AGENCY FOR TOXIC SUBSTANCES & DISEASE REGISTRY, https://perma.cc/T2YG-YSZJ (last updated Mar. 3, 2011).

or acute exposure.[133] For example, exposure to one nanogram of hexavalent chromium per cubic meter of air can result in up to 150 additional cancer cases per million people.[134] Lead is so toxic that there is no known safe blood level for lead.[135] Children with blood lead levels exceeding five micrograms per deciliter ("ug/dl") are at greater risk of developing neurological disorders, learning disabilities, and damage to their nervous systems.[136]

The risks of exposure and harm from these and other air toxics are inequitably distributed. Along an eighty-five-mile stretch of Louisiana's coast known as Cancer Alley, more than 150 chemical plants and oil refineries release harmful toxins into the air day and night.[137] In 2016, the EPA acknowledged that residents of St. John the Baptist Parish, an African American community within Cancer Alley, faced the highest cancer risk in the nation from air pollution due to emissions from nearby petrochemical plants.[138] EPA's presumptive level of unacceptability is 100-in-1 million people.[139] Cancer risks in St. John the Baptist Parish were as high as 1,505-in-1 million.[140]

In 2021, residents of St. John the Baptist Parish filed a petition with the EPA requesting emergency action under the Clean Air Act to protect residents from toxic chemicals emitted by industrial sources.[141] The petition asserted that the concentration of one air toxin, chloroprene, was 8,000 times higher than that deemed safe by EPA scientists.[142] Ninety-four percent of the population within one mile of the main plant releasing chloroprene is Black.[143] Other toxins, such as ethylene oxide, are also insufficiently regulated and add to the cancer risk in the community.[144] To address this gap, the petition further requested the EPA to review and revise the national standards that govern the toxic air emissions.[145] These problems are not isolated to Cancer Alley. More than half a million

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133. *See e.g., Assessing Exposure*, IND. DEP'T OF ENV'T MGMT., https://perma.cc/Q55P-G4LY (last visited Oct. 25, 2022).

134. *Health Effects of Hexavalent Chromium,* SOUTH COAST AIR QUALITY MGMT. DIST. (May 6, 2008), https://perma.cc/YYV3-VLWD.

135. T. Vorvolakos et al., *There is No Safe Threshold for Lead Exposure: A Literature Review*, 27 PSYCHIATRIKI 204, 204 (2016).

136. *What Are Possible Health Effects from Lead Exposure?*, AGENCY FOR TOXIC SUBSTANCES & DISEASE REGISTRY, https://perma.cc/B68F-BF8J (last updated July 2, 2019).

137. RUHAN NAGRA ET AL., *"Waiting to Die": Toxic Emissions and Disease Near the Denka Performance Elastomer Neoprene Facility in Louisiana's Cancer Alley*, 14 ENV'TL JUST. 14, 15 (2019).

138. Concerned Citizens of St. John, Petition to the Administrator, United States Environmental Protection Agency, Petition for Emergency Action under the Clean Air Act, 42 U.S.C. § 7603 et seq., to Abate the Imminent and Substantial Danger to St. John the Baptist Parish, Louisiana Residents from Toxic Air Pollution 1 (May 6, 2021), https://perma.cc/3SJR-MA65.

139. *Id.* at 2.

140. *Id.* at 1.

141. *Id.*

142. *Id.*

143. *Id.* at 7.

144. *Id.* at 1.

145. *Id.*

individuals face cancer risks that exceed EPA guidelines because of exposure to one or more of the 187 chemicals listed by the EPA as toxic air pollutants.[146] Nationally, non-White Hispanics and Black Americans experience higher personal exposure to aromatic air toxics.[147] Exposure to air toxics increases the risk of developing cancer and may play some role in the high cancer risk experienced by these groups. [148]

III. AIR POLLUTION AND RESPIRATORY PANDEMICS: THE IMPACTS OF CO-MORBIDITIES AND CLIMATE CHANGE

The Industrial Revolution, driven by the large scale use of coal and other fossil fuels, revolutionized manufacturing, power distribution, transportation, and led to other societal benefits.[149] But it also caused air pollution to increase rapidly, resulting in respiratory illness and higher death rates throughout the world.[150] The 1918 influenza pandemic is recognized as one of the worst catastrophes in human history.[151] More than one-third of the world's population was infected with the H1N1 virus that ultimately killed 50 million people.[152] Given the pathology of the H1N1 virus on lung function and the high levels of air pollution released by unregulated industries in densely populated cities during the period, exposure to air pollution likely played an important role in the heightened transmission and mortality rates.[153] More than a century later, localized air pollution remains a major problem and has contributed significantly to the risks of contracting and surviving the latest global respiratory pandemic—COVID-19.[154]

A. THE LINK BETWEEN AIR POLLUTION AND COVID-19 OUTCOMES

As of January 2023, over 664 million confirmed cases and over 6.7 million COVID-19 related deaths have been reported throughout the world since the start

146. Michael Hawthorne, *More Than Half a Million Americans Exposed To Toxic Air Pollution Face Cancer Risks Above EPA Guidelines,* CHICAGO TRIBUNE (July 25, 2019), https://perma.cc/7V4Y-SH5Q.

147. Jennifer C, D'Souza et al., *Ethnicity, Housing and Personal Factors as Determinants of VOC Exposures,* 43 ATMOS. ENVIRON. 2884, 2890 (2009).

148. *The State of Cancer Health Disparities in 2022*, AM. ASS'N CANCER RSCH. (2022), https://perma.cc/2EXA-9AF5; *see also Cancer Facts & Figures for African Americans*, AM. CANCER SOC'Y, https://perma.cc/JNE3-MUS4 (last updated Apr. 7, 2021) (noting that nationally, the Black population has the highest death rate and shortest survival rate of any racial and ethnic group for most cancers).

149. *Industrial Revolution*, HISTORY (Oct. 29, 2009), https://perma.cc/3V38-D8KJ.

150. Patrick J. Kiger, *7 Negative Effects of the Industrial Revolution*, HISTORY (Nov. 9, 2021), https://perma.cc/3XJ9-5YPR.

151. Karen Clay et al., *Pollution, Infectious Disease, and Mortality: Evidence from the 1918 Spanish Influenza Pandemic,* (Nat'l Bureau of Econ. Rsch., Working Paper No. 21635, 2015).

152. *Id.*

153. *Id.*

154. *Coronavirus and Air Pollution,* HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH, https://perma.cc/A2XC-RTSG, (last visited Nov. 1, 2022).

of the pandemic.[155] Although the full etiology of COVID-19 is still under investigation, it is now well established that air pollution can accelerate the spread and severity of respiratory pandemics like COVID-19 in two significant ways.[156] First, particulate matter and other pollutants act as carriers of airborne pathogens to augment transmission rates.[157] In fact, the reproduction ratio ("R0") of COVID-19 has been directly correlated with long-term ambient $PM_{2.5}$ exposure levels.[158] Smaller particles such as $PM_{2.5}$ are particularly dangerous because they remain airborne for longer periods, collect pathogens, and may eventually be inhaled and settle deep into an individual's respiratory system to significantly increase health risks.[159] Second, prior exposure to pollutants leads to the development of respiratory co-morbidities such as asthma, chronic pulmonary disease, lung cancer, and respiratory tract infections that render individuals more susceptible to respiratory viral infection.[160] A growing body of research has shown that chronic exposure to polluted air worsens the effects of COVID-19.[161] One study concluded that there is an eleven percent increase in mortality from COVID-19 infection for every one microgram per cubic meter increase in air pollution.[162] Similarly, a study that evaluated data from 3,000 counties found that a small increase in long-term $PM_{2.5}$ exposure was associated with significant increases in COVID-19 death rate.[163]

As shown in other studies on respiratory pandemics such as Severe Acute Respiratory Syndrome ("SARS"), also a coronavirus, and other respiratory infections including influenza, breathing more polluted air increases the risks of infection and death.[164] Patients with existing co-morbidities linked to chronic exposure to air pollutants were twice as likely to suffer severe COVID-19 infections requiring intensive care.[165] Exposure to air pollutants was positively

155. *WHO Coronavirus (COVID19) Dashboard*, WORLD HEALTH ORG., https://perma.cc/DCM6-AEB6 (last visited Nov. 1, 2022).

156. *See e.g.,* Gongbo Chen, *The Impact of Ambient Fine Particles On Influenza Transmission and The Modification Effects Of Temperature in China*, 98 ENV'T INT'L 82 (2017).

157. Yang Zhao, *Airborne Transmission May Have Played a Role In The Spread of 2015 Highly Pathogenic Avian Influenza Outbreaks in the United States*, 9 SCI. REPS. 1, 7 (2019).

158. Rjan K. Chakrabarty et al., *Ambient $PM_{2.5}$ Exposure and Rapid Spread of COVID-19 in the United States,* 760 SCI. TOTAL ENV'T 143391, 1 (2021) (The basic reproduction ratio R0 denotes the expected number of people each sick person can infect. Where R0 is greater than one, one person can spread an illness to more than one person and the illness can spread rapidly).

159. Zhao, *supra* note 157, at 7.

160. Xiao Wu et al., *Exposure to Air Pollution and COVID-19 Mortality in the United States*, 6 SCI. ADVANCES 1, 3–5 (2020).

161. *Coronavirus and Air Pollution, supra* note 154.

162. Wu et al., *supra* note 160, at 3.

163. *Id.*

164. Zhao, *supra* note 157.

165. Jing Yang et al., *Prevalence of Comorbidities and its Effects in Patients Infected with SARS-CoV-2*, 94 INT'L J. INFECTIOUS DISEASES 91, 91–92, (2020).

associated with increased infection and fatality rates from COVID-19.[166] In one analysis of 120 cities in China, data revealed a significant relationship between air pollution and COVID-19 infection as well as positive associations of $PM_{2.5}$, PM_{10}, CO, and O_3 with COVID-19 confirmed cases.[167] Elevated exposure to air toxins was associated with a nine percent increase in COVID-19 mortality.[168]

Chronic exposure to NO_2 from tailpipe emissions in urban areas enhances the risk of death from COVID-19.[169] This is because inhalation of NO_2 impairs the function of alveolar macrophages and epithelial cells, which increases the risk of lung infections.[170] In a study of the COVID-19 deaths across sixty-six regions in Italy, Spain, France, and Germany, seventy-eight percent occurred in five regions with the highest levels of NO_2 pollution.[171] Another study showed a positive association between NO_2 pollution and the transmission rate of COVID-19.[172] Alarmingly, the atmospheric concentration of NO_2 capable of inducing adverse COVID-19-related deaths in urban areas was approximately one-fifth the average annual concentration limit imposed under the Clean Air Act.[173]

The impacts of COVID-19 are not shared equally. Recent studies have suggested a link between demographic, racial, and environmental factors, and the increased severity of COVID-19 health outcomes.[174] One study showed that the cumulative COVID-19 hospitalization rates for Black and Latino populations were approximately 4.7 and 4.6 times higher than for non-Hispanic Whites in the United States.[175] A 2020 study found that higher historical $PM_{2.5}$ exposures were

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166. Ye Yao et al., *Temporal Association Between Particulate Matter Pollution and Case Fatality Rate of COVID-19 in Wuhan*, 189 ENV'T RSCH. 109941, 109941 (2020).

167. Yongjian Zhu et al., *Association Between Short-Term Exposure to air Pollution and COVID-19 Infection: Evidence from China*, 727 SCI. TOTAL ENV'T, 138704, 138704 (2020).

168. Michael Petroni, et al., *Hazardous Air Pollutant Exposure as a Contributing Factor to COVID-19 Mortality in the United States,* 15 ENV'T RES. LETT. 940, 940 (2020).

169. Donghai Liang et al., *Urban Air Pollution May Enhance COVID-19 Case-Fatality and Mortality Rates in the United States,* 1 INNOVATION 100047, 100047 (2020).

170. Binod Neupane et al., *Long-term Exposure to Ambient Air Pollution and Risk of Hospitalization with Community-Acquired Pneumonia in Older Adults*, 181 AM. J. RESPIRATORY & CRITICAL CARE MEDICINE 47, 47 (2010) (Alveolar macrophages ingest and break down small, inhaled particles in the lungs. Epithelial cells play an important role in microbial defense).

171. Yaron Ogen, *Assessing Nitrogen Eioxide (NO2) Levels as a Contributing Factor to Coronavirus (COVID-19) Fatality,* 726 SCI. TOTAL ENV'T 138605, 138605 (2020).

172. Ye Yao et al., *Ambient Nitrogen Dioxide Pollution and Spreadability of COVID-19 in Chinese Cities,* 208 ECOTOXICOLOGY & ENV'T SAFETY 111421, 111421 (2021) (Showing the basic reproductive number of COVID-19 was positively associated with NO2 after adjustment for temperature and relative humidity).

173. Marco Mele et al., *NO_2 Levels as a Contributing Factor to COVID-19 Deaths: The First Empirical Estimate of Threshold Values*, 194 ENV'T. RES. 110663, 110663 (2021) (reporting that threshold levels of NO_2 connected to COVID-19 range between 15.8 $\mu g/m^3$ and 22.9 $\mu g/m^3$. Under the Clean Air Act, the annual average annual concentration limit is 100 $\mu g/m^3$.).

174. Marco Mele et al., *NO_2 Levels as a Contributing Factor to COVID-19 Deaths: The First Empirical Estimate of Threshold Values,* 194 ENV'T RES. 110663, 110663 (2021).

175. *COVIDView: A Weekly Surveillance Summary of US. COVID-19 Activity*, CDC (July 23, 2020), https://perma.cc/WP2L-HKHV.

positively associated with higher county-level COVID-19 mortality rates.[176] A 2021 study of cumulative nationwide mortality rates revealed that, considering age, Pacific Islander, Latino, Indigenous, and Black Americans all had COVID-19 death rates at least double that of non-Hispanic White and Asian Americans.[177]

The exposure to toxins increases the risk of health problems that make residents of public housing more likely to contract COVID-19. Crowded living conditions can also increase the risk of contracting the virus.[178] Black, Native American, and Hispanic households are more likely than White households to be extremely low-income renters, many of whom live at or below the national poverty level and rely on public housing.[179] Today, a higher percentage of people from racial and ethnic minority groups live in crowded housing as compared to non-Hispanic White people.[180]

The differences in COVID-19 infection rates and deaths observed in racial and ethnic minorities may be attributed, in part, to their higher levels of exposure in the workplace.[181] Moreover, the severity of the disease in these populations has been largely attributed to existing co-morbidities associated with exposure to elevated air pollution and the reality that racial and ethnic minorities are more likely to live in areas where there is greater air pollution.[182]

The disparate impact of COVID-19 on minority groups has elevated social and racial injustice and inequity to the forefront of public health debate.[183] It is no coincidence that many of the communities hardest hit by COVID-19 are racial and ethnic minority communities located near heavily polluting industries and urban areas with high vehicle emissions.[184] For many people living in those areas, exposure to chronic air pollution likely compromised their respiratory systems

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176. Tanujit Dey & Francesca Dominici, *COVID-19, Air Pollution, and Racial Inequity: Connecting the Dots*, 34 CHEMICAL RES. TOXICOLOGY 669, 669 (2021).

177. Elizabeth Gawthrop, *The Color of Coronavirus: Covid-19 Deaths by Race and Ethnicity in the U.S.,* APM RESEARCH LAB (Oct. 20, 2022), https://perma.cc/7LJM-LEMA.

178. *Considerations for Owners and Operators of Multifamily Housing Including Populations at Increased Risk for Complications from COVID-19*, CDC, https://perma.cc/6YT8-NKL5 (last updated May 5, 2021).

179. *Racial Disparities Among Extremely Low-Income Renters,* NAT'L LOW INCOME HOUS. COAL. (Apr. 15, 2019), https://perma.cc/Q7LE-PU2X.

180. *Risk of Exposure to COVID-19: Racial and Ethnic Health Disparities*, CDC, (Dec. 10, 2020), https://perma.cc/GTW4-EQ38; T.N. Rogers et al., *Racial Disparities in COVID-19 Mortality Among Essential Workers in the United States*, 12 WORLD MED. & HEALTH POL'Y 311, 312 (2020).

181. Lily Casura et al., *Frontline Workers in the U.S.: Race, Ethnicity, and Gender* N-IUSSP (Sept. 7, 2020), https://perma.cc/D9G8-XKMZ (reporting that Black (36%) and Hispanic (33%) workers are much more likely to be employed in frontline occupations than Asians (25%) and non-Hispanic Whites (21%), and are more concentrated in low-paid occupations).

182. D.A. Martinez et al., *SARS-CoV-2 Positivity Rate for Latinos in the Baltimore-Washington, DC Region*, 324 J. AM. MED. ASS'N. 392, 395 (2020); Rogers et al., *supra* note 180, at 312.

183. *See* CDC, *supra* note 180.

184. Katherine Bagley, *Connecting the Dots Between Environmental Injustice and the Coronavirus*, YALE ENVIRONMENT 360 (May 7, 2020), https://perma.cc/XX2G-XHUP.

prior to the pandemic. Climate change and its associated impacts will increase the health risks associated with exposure to air pollution and place already vulnerable populations at increased risk of harm.

B. CLIMATE CHANGE AND AIR POLLUTION

The burning of fossil fuels, including coal, natural gas, and oil to generate energy, results in the emissions of numerous air pollutants, including greenhouse gases that trap heat in the atmosphere.[185] Since the Industrial Revolution, the combustion of these fuels has increased global warming and driven climatic change.[186] Earth's climate is changing faster today than at any time in recorded history, and the rate of warming is accelerating.[187] The ten warmest years on record have occurred during the last decade.[188] The observed changes are primarily driven by human activities including the emissions of heat-trapping greenhouse gases from fossil fuel combustion, deforestation, and land-use change.[189] As land and ocean temperatures increase, the frequency and intensity of certain natural disasters are expected to increase.[190] Some areas will likely experience more heat waves, wildfires, precipitation, and/or more intense storms.[191]

Climate change, warming, and air pollution are closely linked. Climate change alters chemical and physical interactions that create, remove, and transport air pollution.[192] For example, elevated temperatures create conditions favorable to the creation of ground level ozone, particularly over already polluted areas.[193] Increasing temperatures and changes in precipitation increase the risk of drought and wildfires, both of which create particle pollution.[194] Thus, the growing

185. Melissa Denchack, *Fossil Fuels: The Dirty Facts*, NATURAL RES. DEF. COUNCIL (June 1, 2022), https://perma.cc/JLX9-XCUM.

186. NASA, *Global Warming vs. Climate Change*, https://perma.cc/6AEN-3KW5 (last visited Oct. 24, 2022) (explaining the difference between global warming and climate change).

187. *Understand Climate Change*, U.S. GLOB. CHANGE RSCH. PROGRAM, https://perma.cc/F254-UUM3 (last visited Oct. 25, 2022).

188. *2021 was World's 6th-Warmest Year on Record*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. (Jan. 13, 2022), https://perma.cc/S7NV-D72W.

189. Richard P. Allan et al., *Summary for Policymakers* in CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP I TO THE SIXTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, 4–7 (Masson-Delmotte, V. et al. eds., 2021); *see also* Rebecca Lindsey & Luann Dahlman, *Climate Change: Global Temperature*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. (June 28, 2022), https://perma.cc/5TZ7-VRFG ("Earth's temperature has risen by 0.14˚F (0.08˚C) per decade since 1880, and the rate of warming over the past 40 years is more than twice that: 0.32˚F (0.18˚C) per decade since 1981.").

190. Richard P. Allan et al., *supra* note 189, at 8.

191. *Id.*

192. Christopher G. Nolte et al., *Air Quality*, in IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES: FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II 512, 517 (D.R. Reidmiller et al. eds., 2018).

193. *Id.* at 516.

194. *Climate Change and Air Pollution,* AM. LUNG ASS'N, https://perma.cc/XQY4-RC6S (last updated March 14, 2020).

impacts of warming and climatic change must be considered to create effective air pollution regulation.

Although the impacts of climate change will affect all Americans, racial and ethnic minorities living near industrial facilities or contaminated land are uniquely vulnerable to the devastating weather events anticipated from climatic changes. Many pollution-emitting facilities are not fully equipped to deal with flooding from increasingly stronger storms. For example, EPA reported that Hurricane Harvey was responsible for the unauthorized release of 8.3 million pounds of air pollution from industrial facilities.[195] Some petrochemical plants in the area released cancer-causing benzene at rates six times higher than safe levels.[196] A 2019 study revealed that approximately sixty percent of Superfund sites overseen by EPA are in areas that may be impacted by climate-induced changes in flooding, storm surge, wildfires, and sea level.[197] These impacts could cause the release of additional toxins into the air and water, increasing the risk for the seventeen million minority and low-income people who currently live within five miles of these Superfund sites.[198]

High temperatures increase the risk of a range of illnesses and death.[199] Climatic changes are expected to exacerbate warming in cities already impacted by urban heat islands.[200] Vulnerable communities—especially those within urban areas—are already disproportionately exposed to extreme heat.[201] This is troubling for near-source communities because evidence suggests that there may be a higher association between long-term $PM_{2.5}$ exposure and mortality in warmer cities.[202] Studies suggest that the impacts of climate change will be felt disproportionately by vulnerable and socially marginalized populations that already suffer socio-economic inequalities.[203] In communities already overburdened with poor environmental conditions, climate change poses substantial new risks that must be considered. Racial and ethnic minorities are expected to be more vulnerable

195. ENVIRONMENTAL INTEGRITY PROJECT, PREPARING FOR THE NEXT STORM: LEARNING FROM THE MAN-MADE ENVIRONMENTAL DISASTERS THAT FOLLOWED HURRICANE HARVEY 1 (Aug. 16, 2018), https://perma.cc/WFT2-KDSR.

196. *Id*. at 15.

197. U.S. GOV'T ACCOUNTABILITY OFF., GAO-21-555T, SUPERFUND: EPA SHOULD TAKE ADDITIONAL ACTIONS TO MANAGE RISKS FROM CLIMATE CHANGE EFFECTS 7 (2021).

198. JACOB CARTER & CASEY KALMAN, CTR. FOR SCI. & DEMOCRACY, A TOXIC RELATIONSHIP: EXTREME COASTAL FLOODING AND SUPERFUND SITES 7 (July 2020), https://perma.cc/HZ62-LF24.

199. *Climate Change Indicators: Heat-Related Deaths*, EPA, https://perma.cc/2FLC-79DH (last updated Aug. 2, 2022).

200. Kangning Huang et al., *Projecting Global Urban Land Expansion and Heat Island Intensification Through 2050*, 14 ENV'TL RSCH. LETTERS 114037, 114037 (2019).

201. Jeremy S. Hoffman et al., *The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas*, 8 CLIMATE 1, 1 (2020).

202. *See* Marianthi-Anna Kioumourtzoglou et al., *PM2.5 and Mortality in 207 U.S. Cities: Modification by Temperature and City Characteristics,* 27 EPIDEMIOLOGY 221, 221 (2016).

203. *See e.g*., Seth B. Shonkoff et al., *The Climate Gap: Environmental Health and Equity Implications of Climate Change and Mitigation Policies in California—a Review of the Literature*, 109 CLIMATIC CHANGE S485, S485 (2011).

to heat waves, extreme weather events, environmental degradation, and dislocations.[204]

Numerous peer-reviewed studies have concluded that there is a nexus between exposure to air pollution and enhanced risk of adverse outcomes from respiratory diseases, such as COVID-19.[205] Other studies show a nexus between climatic changes and declining air quality.[206] Still others show a nexus between human activities that drive climate change and the emergence of new pandemics.[207] Because climate change is accelerating, and because human activities that drive climate change also increase the risk for the emergence of new, more deadly pandemics, it is essential that policy makers take a more holistic approach to addressing both problems.[208] Any approach to solving these complex problems must address the lingering impacts of discriminatory practices and policies that continue to expose vulnerable populations to increased risks of harm.

IV. ENVIRONMENTAL JUSTICE AND THE INEQUITABLE DISTRIBUTION OF ENVIRONMENTAL HARMS

The environmental justice movement began in the late 1960s during the Civil Rights Movement when people of color sought to address the inequity of environmental protection in their communities.[209] The movement quickly grew to address inequities in the distribution of adverse environmental and health consequences of industrial activities, unequal enforcement of environmental laws, discriminatory zoning and land use practice, and exclusionary policies and practices that limited or prevented meaningful participation in decision making by those individuals most impacted by facility siting decisions.[210] Grassroot activists took steps to organize, educate, and empower affected communities and used the power of protest and public opinion to force governments to apply and enforce environmental laws equally. According to Barry Hill, who headed the EPA Office of Environmental Justice for nine years, today the movement is a "synthesis of civil rights protest methods, legal principles and doctrines, and environmental protection theories, techniques and approaches that are aimed at redressing the

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204. *Id.* at S486.

205. *See Coronavirus and Air Pollution*, *supra* note 154.

206. *See e.g.*, Chaopeng Hong et al., *Impacts of Climate Change on Future Air Quality and Human Health in China*, 116 PROC. NAT. ACAD. SCIS. 17193, 17193 (2019).

207. Nundu Sabitit Sabin et. al., *Implications of Human Activities for (Re)Emerging Infectious Diseases, Including COVID-19*, 39 J. PHYSIOLOGICAL ANTHROPOLOGY 1, 3 (2020).

208. Michael Penn, *Statistics Say Large Pandemics Are More Likely Than We Thought*, DUKE GLOB. HEALTH INST. (Aug. 23, 2021), https://perma.cc/F2BU-R2FG; Eleni Smithham & Amanda Glassman, *The Next Pandemic Could Come Soon and Be Deadlier*, CTR. FOR GLOB. DEV. (Aug. 25, 2021), https://perma.cc/BS3Y-3V3T.

209. *Environmental Justice Timeline*, EPA, https://perma.cc/3S8A-KPCU (last updated July 18, 2022).

210. Robert D. Bullard & Glen S. Johnson, *Environmental Justice: Grassroots Activism and Its Impact on Public Policy Decision Making*, 56 J. SOC. ISSUES 555, 557–558 (2000).

disproportionate burden of risk and exposure to pollution in minority and/or low-income communities."[211] Environmental justice advocates broadly assert that it is a basic right of all Americans to live and work in a clean and healthy environment, that all communities should bear a proportionate share of environmental pollution and health risks, and that the benefits and burdens of industrial activities should be equally distributed throughout society.[212] Advocates also assert that discriminatory laws and policies have placed racial and ethnic minority communities in direct proximity to environmental toxins, forcing them to make disproportionate health and economic sacrifices that more affluent communities can avoid.[213]

The term "sacrifice zone" has been deployed by the U.S. government and military officials for decades to identify locations (e.g., stretches of the American West, Bikini Atoll, etc.) forever alienated in the wake of nuclear testing and production, uranium mining, and radioactive waste disposal.[214] The term emerged during the Cold War, couched in patriotic rhetoric and moral justification, to identify those places whose destruction or contamination were necessary to protect American interests. The health and environmental impacts suffered by individuals living near national sacrifice zones ravaged by intense pollution was accepted by government as a necessary means to an important, larger social end. Because national sacrifice zones disproportionately impact minority communities, leaving a toxic legacy behind, some environmental justice advocates draw analogies between this national policy and local policies and practices that have forced disadvantaged communities to disproportionately absorb the negative externalities of heavily polluting industries that drive the national economy.[215] These arguments are supported by a considerable body of evidence showing that historic policies and practices allowed for the inequitable distribution of environmental harms and that racial and ethnic minorities continue to suffer disparate health impacts from elevated exposure to pollutants.[216] For example, in one study of 319 commercial hazardous waste treatment, storage, and disposal facilities ("TSDFs") that were sited during the 30-year period from 1966 to 1995, the

211. BARRY HILL, ENVIRONMENTAL JUSTICE: LEGAL THEORY AND PRACTICE (4th ed. 2018).

212. *Id.* at 16.

213. *Id.* at 15.

214. Peter C. Little, *On the Micropolitics and Edges of Survival in a Technocapital Sacrifice Zone*, 28 CAPITALISM NATURE SOCIALISM 62, 62 (2016).

215. Mike Davis, *The Dead West: Ecocide in Marlboro Country*, I/200 NEW LEFT REV. 49, 73 (1993).

216. *See e.g.*, Paul Mohai & Robin Saha, *Which Came First, People or Pollution? Assessing the Disparate Siting and Post-Siting Demographic Change Hypotheses of Environmental Injustice*, 10 ENV'T RSCH. LETTERS 115008; U.S. GEN. ACCT. OFF., SITING OF HAZARDOUS WASTE LANDFILLS AND THEIR CORRELATION WITH RACIAL AND ECONOMIC STATUS OF SURROUNDING COMMUNITIES (1983) https://perma.cc/KSS4-NCCF.

authors concluded that "neighborhoods with already disproportionate and growing concentrations of people of color appear to 'attract' new facility siting."[217]

Pollution exposure disparities result from multiple factors including discriminatory zoning, poorly developed regulatory policy, unequal enforcement of regulations, and unequal political power.[218] Institutional racism, class bias, housing market dynamics, eminent domain, land costs, and other factors also played a role in where highways, landfills, public housing, and heavily polluting industries were placed. District boundary gerrymandering also played a role in the inequitable exposure to toxins faced by racial and ethnic minority communities. In a 2018 study evaluating congressional district gerrymandering and proximity to Superfund sites, the results showed a clear correlation leading the authors to conclude that "minority populations are effectively 'gerrymandered out' of the white and lower environmental hazard districts.[219] Of the myriad of factors contributing to disparate pollution impacts on certain communities, policies and practices related to the siting of industrial facilities and highways, discriminatory zoning, redlining, and public housing have perhaps played the most significant roles in determining who faces elevated exposure to environmental harms.

A. THE LINGERING IMPACTS OF INEQUITABLE SITING OF INDUSTRIAL FACILITIES

Each environmental justice community is unique due to the nature, severity, and duration of exposure; the chemical(s) causing harm; and its location. A considerable body of evidence has shown that minority and/or low-income communities have historically represented the path of least resistance to siting decisions, leading to the disproportionate siting of heavily polluting facilities and other locally unwanted land uses ("LULUs") in these places. A prime example of this history is evident in Altgeld Gardens, Chicago.

Altgeld Gardens was established as a federal housing project on the South Side of Chicago, Illinois to house African-American World War II veterans.[220] It was built on top of a contaminated landfill.[221] Over time, the area surrounding the community was re-zoned to permit industrial development.[222] The EPA has described the community as being in the center of a "toxic doughnut" because the area surrounding the community has the highest concentration of hazardous waste sites in the nation, including fifty landfills and 382 industrial facilities.[223]

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217. Mohai & Saha, *supra*, note 216 at 115008(16).

218. Shea Diaz, *Getting to the Root of Environmental Injustice*, 29 GEO. ENV'T L. REV. 767, 774–79 (2017).

219. David E. Kramar et al., *A Spatially Informed Analysis of Environmental Justice: Analyzing the Effects of Gerrymandering and the Proximity of Minority Populations to U.S. Superfund Sites*, 11 ENV'T JUST. 29, 29 (2018).

220. *See* HILL, *supra* note 211, at 209.

221. *Id.* at 209-210.

222. *Id.* at 210.

223. *Id.*

The area also had approximately 250 leaking underground storage tanks.[224] Toxicology studies conducted in the community since the 1980s revealed dangerous levels of mercury, lead, dichlorodiphenyltrichloroethane (DDT), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), heavy metals, and xylene.[225]

Residents of Altgeld Gardens have reported unusually high levels of childhood birth defects, higher than normal rates of cancer, and other health abnormalities that they claim are caused by excessive chemical exposure.[226] Despite this, the government has been slow to clean up the area, has failed to fully inform residents of risks faced, and has failed to involve the community in key decision making. For residents, the connection between excessive exposure to pollutants and death rates is so clear that the community established a memorial wall listing the names of those members who are believed to have died from pollution exposure.[227] Altgeld Gardens represents one of thousands of environmental justice communities throughout the nation that continue to be affected by early siting decisions. Today, many semi-industrial areas remain largely populated by Blacks, Latinos, Native Americans, and low-income families.[228]

Two major studies in the 1980s concluded that the racial makeup of a community played a primary role in the decision to site off-site hazardous waste landfills[229] and TSDFs.[230] A follow-up study in 2000 reported that people of color were concentrated in neighborhoods and communities with the greatest number of hazardous waste facilities.[231] A 2005 review of census data tracts and industrial air pollution revealed that minorities were seventy-nine percent more likely than Whites to live in neighborhoods where industrial pollution was suspected of posing the greatest health danger.[232] A 2009 study reported that African Americans were exposed to thirty-eight percent more air pollution than White Americans and were seventy-five percent more likely to live near toxic pollution than the

224. *Id.*
225. *Id.*
226. *Id.*
227. Lisen Holmström, *The Mother of Environmental Justice*, Q. MAGAZINE (May 23, 2018), https://perma.cc/6K3T-HUS4.
228. Danyelle Solomon et al., *Systematic Inequality: Displacement, Exclusion, and Segregation*, CTR. AM. PROGRESS (Aug. 7, 2019), https://perma.cc/7X2D-YYU9.
229. *See* U.S. GEN. ACCT. OFF., *supra* note 216.
230. UNITED CHURCH OF CHRIST COMMISSION FOR RACIAL JUSTICE, TOXIC WASTE AND RACE IN THE UNITED STATES: A NATIONAL REPORT ON THE RACIAL AND SOCIO-ECONOMIC CHARACTERISTICS OF COMMUNITIES WITH HAZARDOUS WASTE SITES at xiv (1987) (The study revealed that three of the five largest commercial hazardous waste landfills in the United States (accounting for approximately 40 percent of the nation's total estimated commercial landfill capacity at the time) were in predominantly African American or Latino communities).
231. UCC, *Toxic Waste*, *supra* note 2, at 63.
232. David Pace, *Minorities Suffer Most from Industrial Pollution*, NBC NEWS (Dec. 13, 2005), https://perma.cc/A7S3-X74W (reporting that an analysis of EPA databases found that factory emissions disproportionately place minorities and the poor at risk).

rest of the American population.[233] More recent studies have revealed similar results. For example, a 2017 study reported that Black Americans were seventy-five percent more likely than White Americans to live in communities near toxic waste facilities.[234] A 2018 study found that a significantly greater proportion of Blacks, Latinos, and people at or near poverty levels tend to live near the most hazardous facilities.[235] The study revealed that approximately thirty-nine percent of the U.S. population lived within three miles of one or more of the approximately 12,500 high-risk chemical facilities.[236] In eight of the nine areas studied, the potential for respiratory illness was higher in fenceline zones than for the entire area, and every area was above the national rate.[237] Another 2018 study found that Black, Hispanic, and poor students were most at risk from air toxins.[238] The study showed that students attending "high risk" public schools nationwide were significantly more likely to be Hispanic, Black, or Asian/Pacific Islander ("API").[239] A University of Michigan study examined 319 commercial hazardous waste TSDFs sited in the United States between 1966 to 1995.[240] The authors found "a consistent pattern over a thirty-year period of placing hazardous waste facilities in neighborhoods where poor people and people of color live."[241] The authors opined that multiple factors contributed to the result including racial discrimination in zoning and the housing market, and siting decisions that were based on following the path of least resistance. African Americans and other minority groups make up approximately fifty-six percent of those living near toxic sites such as refineries, landfills, and chemical plants.[242] As of 2020, approximately seventy percent of hazardous waste sites officially listed on the National Priorities List ("NPL") under the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") are located within one mile of low-income, federally assisted housing populated primarily by racial and ethnic minorities.[243] These and countless other studies reveal that risks associated with environmental hazards disproportionately affect racial and ethnic minorities.

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233. Seth Borenstein, *African Americans, Hispanics Exposed to More Air Pollution Than Whites*, PBS NEWS HOUR (Mar. 12, 2019), https://perma.cc/YP5V-6JMU.

234. NAACP CLEAN AIR TASKFORCE, FUMES ACROSS THE FENCELINE 6 (Nov. 2017), https://perma.cc/RKN7-9ML8.

235. ENV'T JUST. HEALTH ALL., LIFE AT THE FENCELINE: UNDERSTANDING CUMULATIVE HEATH HAZARDS IN ENVIRONMENTAL JUSTICE COMMUNITIES 1 (2018).

236. *Id.* at 3.

237. *Id.* at 16.

238. *See,* Oliver Milman, *Air Pollution: Black, Hispanic, and Poor Students Most at Risk from Toxins – Study*, GUARDIAN (Feb. 1, 2018), https://perma.cc/QHH8-EAAV.

239. *Id.*

240. Mohai & Saha, *supra*, note 216.

241. *Id.*

242. UCC, *Toxic Waste, supra* note 2, at 52.

243. *See Superfund: National Priorities List (NPL)*, EPA, https://perma.cc/KG82-H3BY (last updated Mar. 11, 2022).

Other studies have reported race-based inequities in enforcement of penalties levied on polluting industries and on cleanup efforts.[244]

Although existing regulations and policies help minimize the release of harmful toxins, accidental or unintended releases still occur as part of normal business operations.[245] The EPA has noted that approximately 150 "reportable" incidents of accidental or unplanned chemical releases occur each year at the nation's high-risk facilities that produce, use, or store significant amounts of certain highly toxic or flammable chemicals.[246] For example, on May 4, 2021, Marathon Petroleum's refinery in Houston, Texas released a poisonous cloud of hydrofluoric acid gas, resulting in the evacuation of several thousand residents in nearby communities.[247] Between April and May of 2021, the recently reopened Limetree Bay Refinery in St. Croix experienced three separate accidental or unintended releases of sulfur dioxide (SO_2), a toxic gas that endangered the health of nearby communities.[248] The long-term effects of exposure on these communities is unknown.

Today, industries legally emit air toxics pursuant to "safe" standards specified under the Clean Air Act implementing regulations.[249] They also release large quantities of pollutants during startup and shutdown and because of accidents that are not captured in the permits issued. For individuals living adjacent to heavily polluting industries, however, the risks of harm are elevated.[250] Across the country, due in part to discriminatory siting practices and policies, communities closest to hazardous facilities are disproportionately Black, Latino, and impoverished.[251] Communities exposed to hazardous levels of air pollution have higher per capita COVID-19 death rates.[252] To protect vulnerable populations from the impacts of climate change and future pandemics, policymakers must

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244. Marianne Lavelle & Marcia Coyle, *Unequal Protection: The Racial Divide in Environmental Law – A Special Investigation*, 15 NAT'L L.J. S1, S4 (1992) (reporting that the average Superfund fine imposed on polluters in white areas was 506 percent higher than the average fine imposed in minority communities and that cleanup efforts in minority communities took longer even though they were less intensive than those in white areas).

245. Accidental or unintended releases are distinct from the daily toxic releases that are allowed under most operating permits.

246. Accidental Release Prevention Requirements: Risk Management Programs Under the Clean Air Act, 84 Fed. Reg. 69834, 69861 (Dec. 19, 2019) (to be codified at 40 CFR pt. 68).

247. Erwin Seba, *Marathon Petroleum Refinery in Texas Issues Alert Over Chemical Leak*, REUTERS (May 4, 2021), https://perma.cc/Z2AT-MVGC.

248. Laura Sanicola, *U.S. Halts Operations at Caribbean Oil Refinery After Breakdowns,* REUTERS (May 14, 2021), https://perma.cc/D8CG-2LT2.

249. *See Operating Permits Issued under Title V of the Clean Air Act*, EPA https://perma.cc/F2RN-4HVM (last updated Oct. 4, 2022).

250. Brender et al., *supra* note 98, at S37.

251. ENV'T JUST. HEALTH ALL., *supra* note 235, at 1.

252. Kimberly Terrell & Wesley James, *Air Pollution and COVID-19: A Double Whammy for African American and Impoverished Communities in Cancer Alley*, 11 (forthcoming), https://perma.cc/7CXM-8NN7.

recognize and address the strong correlation between siting decisions, race, and public health.

B. THE LINGERING IMPACTS OF INEQUITABLE SITING OF HIGHWAYS AND MAJOR ROADWAYS

In 1956, Congress passed the Federal Aid Highway Act authorizing the construction of 41,000 miles of interconnected highways through and around major city centers.[253] The construction proceeded primarily through historic Black and Hispanic neighborhoods, despite the availability of alternate routes, forever altering communities and driving racial inequality in those areas.[254] Highway and roadway expansion also brought increased pollution to these areas. The concentration of criteria pollutants and air toxics emitted from mobile sources is higher near major roads.[255] Concentrations are generally highest within 500-600 feet of the roadway, but the distance may increase based on wind velocity.[256]

More than forty-five million people in the United States live within 300 feet of a major highway, railroad, or airport.[257] Many schools and child-care centers are located within a few hundred feet of major roadways.[258] Studies show that racial and ethnic minorities, particularly in urban areas, are disproportionately exposed to on-road sources of air pollution and face higher risks for adverse health outcomes, including asthma, cardiovascular disease, and impaired lung development.[259] Studies also show that chronic exposure to vehicle air pollutants is strongly correlated with increased risks of developing diseases that are contributory risk factors for COVID-19 fatalities.[260] Individuals with pre-existing asthma, cardiovascular disease, or impaired lung development are more vulnerable to

253. Federal-Aid Highway Act of 1956, Pub. L. No. 84-627, 70 Stat. 347 (codified as amended in scattered sections of 23 U.S.C.).

254. Andy Sullivan, U*.S. Freeways Flattened Black Neighborhoods Nationwide*, REUTERS (May 25, 2021), https://perma.cc/GJ5F-EUCZ; Erin Blakemore, *Interstate Highways Were Touted as Modern Marvels. Racial Injustice Was Part of the Plan.* WASH. POST (Aug. 17, 2021), https://perma.cc/5BS8-RC2A (noting that Logan Heights, a bastion of San Diego's Latino community, was severed in two by Interstate 5 and Black Bottom, Detroit's majority-Black neighborhood, was bulldozed to make way for Interstate 375).

255. EPA, *supra* note 62, at 1.

256. *Id*. at 2.

257. *Id*. at 1.

258. *Id*. at 3.

259. Gregory C. Pratt et al., T*raffic, Air Pollution, Minority and Socio-Economic Status: Addressing Inequities in Exposure and Risk*, 12 INT'L J. ENV'T RSCH. PUB. HEALTH 5355,5365 (2015) (showing that whites and high socioeconomic status groups had lower traffic exposure and lower risk from air pollution from all sources, while exposure and risks were systematically higher than the mean for all non-white population groups and lower socio-economic status).

260. *See e.g*., Conor Gately & Tim Reardon, *Racial Disparities in the Proximity to Vehicle Air Pollution in the MAPC Region*, METRO. AREA PLAN. COMM'N (Boston) (May 2020), https://perma.cc/B8AF-5CSV.

health impacts of climate change.[261] Thus, to protect vulnerable populations from the impacts of climate change and future pandemics, policymakers must recognize and address the strong correlation between race, proximity to major roadways, and public health.

C. THE LINGERING IMPACTS OF RACIAL ZONING, REDLINING, AND PUBLIC HOUSING

Discriminatory policies and practices related to zoning, redlining, and public housing have all played significant roles in determining who faces elevated exposure to environmental harms.

1. Discriminatory Zoning

Zoning was introduced in the early 1900s as a tool for social reform and land use control.[262] It quickly became a tool to segregate communities. In 1910, Baltimore, Maryland enacted the first racial zoning ordinance.[263] Many states followed by adopting zoning ordinances that enforced residential segregation. In 1917, the U.S. Supreme Court unanimously struck down a racial zoning ordinance in *Buchanan v. Warley*, ending the ability to use zoning to separate communities exclusively based on race.[264] However, because the ruling did not apply to private agreements, the use of racially restrictive covenants became a common practice.

In *Village of Euclid v. Ambler Realty Co.,* the U.S. Supreme Court held that zoning fell under a local government's police power and was constitutional so long as it related to the safety, welfare, health, or morals of the public.[265] That decision set off a wave of zoning that dominated land use planning for decades. So called *Euclidean* zoning held the promise of improving the quality of life for all residents by separating incompatible land uses such as industry and residential developments. Under this scheme, residential homes typically would be separated from pollution emitting factories to avoid the health-related impacts of exposure to harmful contaminants.[266] In addition to creating exclusive residential districts, in time, most zoning also allowed for mixed uses that permitted industrial and commercial facilities within residential districts.[267] Because homes within

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261. *See Climate Change and the Health of People with Chronic Medical Conditions*, EPA, https://perma.cc/3REM-QZVS (last updated Aug. 30, 2022).

262. Peter L. Abeles, *Planning and Zoning*, in ZONING AND THE AMERICAN DREAM: PROMISES STILL TO KEEP 122, 127 (Charles M. Haar & Jerold S. Kayden, Am. Plan. Assoc. eds., 1990).

263. Allison Shertzer et al., *Zoning and Segregation in Urban Economic History* 7 (Nat'l Bureau of Econ. Rsch., Working Paper No. 28351, 2021).

264. Buchanan v. Warley, 245 U.S. 60, 82 (1917).

265. Vill. of Euclid v. Ambler Realty Co. 272 U.S. 365, 389–90 (1926).

266. *See, e.g.,* Juliana Maantay, *Zoning, Equity, and Public Health*, 91 AM. J. PUB. HEALTH 1033, 1033 (2001).

267. *Id.* at 1036–38.

exclusive residential districts were more desirable, and therefore more expensive, the zoning scheme led to economic segregation.[268]

Euclid was decided in a period of legal segregation and many communities used their zoning power to indirectly perpetuate racial and economic segregation.[269] The legal siting of public housing projects for Black occupancy furthered residential segregation, as did neighborhood planning, private deed restrictions, and racially charged real estate practices.[270] Addressing the evolution of zoning in America, urban planner Yale Rabin noted, "what began as a means of improving the blighted physical environment in which people lived and worked" became "a mechanism for protecting property values and excluding the undesirables."[271] In time, many exclusively African-American communities were rezoned to permit industrial development. Soon zoning's promise of separating incompatible land uses to improve the health and safety of all community members disappeared. In its place emerged a scheme that encouraged incompatible uses in areas drawn largely along lines of race and class.[272] Numerous studies have concluded that planners disproportionately zoned for industry within minority and lower-income communities and thereby increased the exposure of those communities to the higher pollution burdens.[273] As previously discussed, proximity to industry elevates pollution exposure, which elevates the risk of contracting respiratory diseases that render individuals more susceptible to the health impacts from climate change and pandemics.

2. Redlining

As part of President Roosevelt's New Deal, Congress passed the Home Owners' Loan Act of 1933.[274] To help lift the United States out of the Depression, the Act created the Home Owners' Loan Corporation ("HOLC") to assist homeowners who were in default on their mortgages and to prevent foreclosure.[275] In the process, the HOLC included in the Fair Housing Administration Underwriting Handbook residential security maps which were color-coded

268. *See, e.g.*,Richard Florida, *How Zoning Restrictions Make Segregation Worse*, BLOOMBERG (Jan. 4, 2016), https://perma.cc/EB7E-9ED2; Eliza Hall, *Divide and Sprawl, Decline and Fall: A Comparative Critique of Euclidean Zoning,* 68 U. PITT. L. REV. 916, 925–27 (2007) (discussing how Euclidean zoning led to economic segregation).

269. *Understanding Euclidean Zoning and Its History* REDT HOMES(Feb. 16, 2021), https://perma.cc/U7YJ-V5HE.

270. Allison Shertzer et al., *supra* note 263, at 7; *see also,* Christopher Silver, *The Racial Origins of Zoning in American Cities*, *in* URBAN PLANNING AND THE AFRICAN AMERICAN COMMUNITY: IN THE SHADOWS 23 (Manning Thomas and Marsha Ritzdorf, eds., 1997).

271. Silver, *supra* note 270, at 23.

272. *Id.*

273. *See e.g.*, Andrew H. Whittemore, *Racial and Class Bias in Zoning: Rezonings Involving Heavy Commercial and Industrial Land Use in Durham (NC), 1945-2014*, 83 J. OF AM. PLAN. ASSOC., 235, 237 (2017).

274. Home Owners' Loan Act of 1933, 12 U.S.C. §§1461–1468c.

275. *Id.*

according to racist, anti-Black guidelines: Green ("Best") represented in-demand, up-and-coming neighborhoods where "professional men" lived, lacking "a single foreigner or negro"; Blue ("Still Desirable") represented neighborhoods that had "reached their peak" but were thought to be stable due to their low risk of "infiltration" by non-White groups; Yellow ("Definitely Declining") represented areas considered risky due to the "threat of infiltration of foreign-born, negro, or lower grade populations"; and Red ("Hazardous") represented neighborhoods where "infiltration" (by "people of color" and "foreign-born" individuals) had already occurred.[276] Lending institutions then drew red lines around neighborhoods classified as "hazardous," which were populated almost exclusively by African Americans. In these areas, the Federal Housing Administration ("FHA") often refused to insure mortgages for properties while simultaneously subsidizing the mass-production of entire subdivisions for Whites.[277] Residents in redlined communities were often denied mortgages or refinancing based on the perceived risk. Redlined communities were also often denied capital investment needed to improve the housing and economic opportunity of residents.[278]

The practice of redlining was banned in the United States as part of the Fair Housing Act of 1968, but the impacts of its racist lending and investment practices persist in many cities. Today, most previously redlined communities deemed "Hazardous" remain populated by low-to-moderate income minorities, while those previously deemed "Best" remain predominantly White with above-average incomes.[279] Previously redlined communities continue to suffer from higher poverty, higher unemployment, higher violent crime rates, higher levels of industrial pollution, lower home ownership, and are more likely to be identified as medically underserved.[280]

Tied to this redlining legacy are lingering health concerns. A 2020 study comparing historical residential redlining to current asthma-related emergency department visits, found that the proportion of the population that was non-Hispanic Black and Hispanic, the percentage of the population living in poverty, and the ambient concentration of diesel exhaust particle emissions all significantly increased as security map risk grade worsened.[281] Previously redlined communities may also face a disproportionate risk of heat-related impacts and

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276. BRUCE MITCHELL & JUAN FRANCO, NATIONAL COMMUNITY REINVESTMENT COALITION, HOLC "REDLINING" MAPS: THE PERSISTENT STRUCTURE OF SEGREGATION AND ECONOMIC INEQUALITY 5 (2018), https://perma.cc/KHR3-QKPB.

277. *Id.* at 8.

278. *Id.* at 4.

279. *Id.* (finding that 74 percent of the neighborhoods that the HOLC graded as high-risk, or "Hazardous" eight decades ago are low-to-moderate income (LMI) today and that nearly 64 percent of those communities are minority neighborhoods now).

280. *Id.* at 18.

281. Anthony Nardone et al., *Associations Between Historical Residential Redlining and Current Age-Adjusted Rates of Emergency Department Visits due to Asthma Across Eight Cities in California: An Ecological Study*, 4 LANCET PLANETARY HEALTH, E24, E25 (2020).

exposure to air pollution.[282] A study comparing digital maps of historically redlined neighborhoods with maps showing the highest heat levels found a consistent correlation.[283] Due to the absence of trees, abundance of asphalt and other physical factors such as major roadways and industrial zones in these areas, residents can experience increased local temperature differences from five degrees to twenty degrees Fahrenheit during the summer.[284] The study also showed that areas within the same city, near parks and other green spaces cooled down the surrounding areas.[285] Policymakers must recognize that harmful microclimates exist within pockets of larger communities and develop more protective air pollution regulations to protect vulnerable individuals living in those areas.

3. Public Housing

Public housing in America began as part of the New Deal under the Wagner-Steagall Housing Act.[286] The Act authorized federal loans and annual contributions to local public housing agencies for low-rent public housing in cities for low-income and vulnerable families impacted by the Depression. Construction of public housing accelerated under the Housing Act of 1949, which set the goal of providing "a decent home and a suitable living environment for every American family."[287] Separate public housing projects were built for White and African American communities. At the same time the FHA and lenders embraced harmful redlining policies and practices, the FHA began subsidizing the mass construction of White-only subdivisions that led Whites to migrate away from the cities and away from public housing.[288] White-only public housing projects were eventually opened for occupancy to African Americans who were becoming poorer and less able to afford housing due to changing employment opportunities.[289] Over time, direct funding for public housing fell and conditions deteriorated. Rezoning eventually allowed for industrial development near public housing. This change shifted the burden of pollution toward poorer public housing communities.

Many federally subsidized housing complexes were built on cheap land in industrial, polluted areas before environmental assessments were required under federal regulation. A 2020 report revealed that approximately 77,000 families in 1,000 public housing properties are located within a mile of one or more

282. Daniel Cusick, *Past Racist "Redlining" Practices Increased Climate Burden on Minority Neighborhoods*, SCI. AM. (Jan. 21, 2020), https://perma.cc/H3TB-Z3NZ.

283. Jackson Voelkel et al., *Assessing Vulnerability to Urban Heat: A Study of Disproportionate Heat Exposure and Access to Refuge by Socio-Demographic Status in Portland, Oregon*, 15 INT'L J. ENV'T RSCH. & PUB. HEALTH, 640, 649 (2018).

284. *Id.* at 648.

285. *Id.*

286. United States Housing Act of 1937, 42 U.S.C §1437.

287. Housing Act of 1949, 42 U.S.C. §1441.

288. *See generally*, RICHARD ROTHSTEIN, THE COLOR OF LAW: A FORGOTTEN HISTORY OF HOW OUR GOVERNMENT SEGREGATED AMERICA (2017).

289. *Id.*

Superfund sites, placing minority and low-income residents in direct proximity to environmental toxins.[290] This problem is well known to housing officials. In a 2020 report, the Department of Housing and Urban Development ("HUD") Office of Inspector General requested money in its annual budget to investigate the threat to public housing residents from Superfund sites, noting that "[t]he dangers posed to HUD programs by inadequately responding to this looming risk of unsanitary and unsafe housing are incalculable."[291]

Inadequate housing is a significant public health issue.[292] It is associated with a wide variety of health conditions, including respiratory infections, asthma, lead poisoning, injuries, and mental health issues.[293] The proximity of housing to sources of pollution can potentially exacerbate these conditions and may render individuals more susceptible to the health impacts of climate change and future pandemics. Policymakers must recognize the cumulative health impacts experienced by individuals forced to live in substandard housing that is situated close to major sources of pollution.

V. RECOMMENDATIONS TO ADDRESS ENVIRONMENTAL INJUSTICE AND TO PROMOTE HEALTH EQUITY

The environmental justice movement emerged to address the inequity of environmental protection observed within racial and ethnic minority communities throughout the country. Subsequent social and scientific studies that documented the disparate environmental impacts within these communities galvanized grassroots efforts to fairly distribute environmental harms and benefits throughout society. The pioneering work of community activists moved the issue of environmental injustice to the forefront of national debate, but for many residents on the frontline of exposure, little has changed. Despite repeated setbacks, environmental justice advocates continue to push for the development of enforceable laws and policies to protect vulnerable communities from environmental harm. In the absence of federal law governing environmental justice, federal agencies have no direct enforceable authority, other than provisions within existing laws, to require that regulated entities take action to address environmental injustice. President Biden has made addressing persistent racial and economic disparities a core part of his administration. He has linked addressing racial and social injustice to a broader plan to combat climate change.

Upon taking office, President Biden signed the American Rescue Plan Act which provided significant funding for environmental justice related programs.[294]

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290. SHRIVER CENTER ON POVERTY LAW, POISONOUS HOMES, THE FIGHT FOR ENVIRONMENTAL JUSTICE IN FEDERALLY ASSISTED HOUSING 11 (June 2020).

291. OFF. OF INSPECTOR GEN., DEPT. OF HOUS. AND URB. DEV., ANNUAL BUDGET, at 52-2 (2020).

292. James Krieger & Donna L. Higgins, *Housing and Health: Time Again for Public Health Action*, 92 AM. J. PUB. HEALTH 758, 758 (2002).

293. *Id.*

294. American Rescue Plan Act of 2021, Pub. L. No. 117-2, 135 Stat. 4.

He also issued two Executive Orders that prioritized environmental justice.[295] In one Order, President Biden linked tackling climate change, promoting economic revitalization, and developing green jobs to environmental justice.[296] Section 223 of the Order creates a Justice40 Initiative, which directs agencies across the federal government to invest in low-income and minority communities that have traditionally borne the brunt of pollution by ensuring that forty percent of the overall benefits from federal clean energy investments flow to disadvantaged communities.[297] The Order also creates two new White House councils, the White House Environmental Justice Interagency Council and the White House Environmental Justice Advisory Council, to address environmental justice implementation. The order also requires publication of an Environmental Justice Scorecard detailing agency environmental justice performance measures.[298] In response, the EPA Administrator, Michael S. Regan, directed all EPA offices to clearly integrate environmental justice considerations into their plans and actions.[299] These steps are appropriate and necessary, but more is needed. The global spread of COVID-19 was facilitated by air pollution and exposed health inequities that place racial and ethnic minorities at elevated risk. The EPA has acknowledged that climate change will disparately impact racial and ethnic populations.[300] Climate change is expected to alter weather patterns in ways that increase certain forms of air pollution now known to augment the health risks of COVID-19. The links are clear, so efforts to address one issue must necessarily address the others.

COVID-19 is unlikely to be a once-in-a-lifetime pandemic. As climate change continues, air pollution and the risk that novel, lethal diseases will impact human populations will likely increase.[301] Yet, during the early stages of the pandemic, the Trump Administration proposed or finalized rules that would result in significant increases in air pollution and weaken protections for those most vulnerable to pollution and the impacts of climate change.[302] In total, the Trump Administration reversed more than 100 environmental laws—actions that have been described as releasing a "pandemic of pollution in the middle of an actual

295. Exec. Order No. 13,990, 86 Fed. Reg. 7037 (Jan. 25. 2021); Exec. Order No. 14,008, 86 Fed. Reg. 7619 (Jan. 27, 2021).

296. Exec. Order No. 14,008, 86 Fed. Reg. 7619, 7629 (Jan. 27, 2021).

297. *Id*. at 7631–32.

298. *Id*. at 7632.

299. Press Release, EPA, EPA Administrator Announces Agency Actions to Advance Environmental Justice (Apr. 7, 2021), https://perma.cc/5CYU-NWUX.

300. ENV'T PROT. AGENCY, CLIMATE CHANGE AND SOCIAL VULNERABILITY A FOCUS ON SIX IMPACTS (2021).

301. Abrahm Lustgarten, *How Climate Change Is Contributing to Skyrocketing Rates of Infectious Disease*, PROPUBLICA (May 7, 2020), https://perma.cc/5FXS-K2NJ.

302. Amy Patronella & Saharra Griffin, *Communities of Color Bear the Brunt of Trump's Anti-Environmental Agenda*, CTR. AM. PROGRESS (Feb. 27, 2020), https://perma.cc/5KAC-7LU8.

pandemic."[303] The economic benefits of deregulation are likely to be dwarfed by the costs of pollution-related healthcare expenses. As of 2023, the federal government has spent more than $4.6 trillion in response to COVID-19, and that number continues to increase as the pandemic lingers.[304] As the Biden Administration works to undo the harmful regulatory changes of the prior administration, it is imperative that lawmakers recognize the interrelationship between air pollution, climate change, disease risk, and healthcare costs when developing new policies to address each component. This starts with addressing environmental injustice in communities most vulnerable to pollution and the impacts of climate change.

Currently, there is no federal environmental justice law. Numerous environmental justice bills have been introduced in Congress over the last decade, all of which died in committee. The latest bill entitled the Environmental Justice for All Act, was reintroduced in 2021,[305] and offers hope for change. The Act would amend the Civil Rights Act of 1964 to allow persons to sue for intentional discrimination.[306] It would amend the Clean Air Act to require that those seeking a permit for projects that would generate air pollution provide analysis of the project's anticipated impact on the surrounding area.[307] It would codify federal directives that require creation of environmental justice strategies.[308] The Act would also require federal agencies to include in their research "diverse segments of the population in epidemiological and clinical studies, including segments at high risk from environmental hazards."[309] It would also authorize funding to help organizations address environmental justice concerns.[310] With new leadership in Congress and the White House, there is renewed hope that federal environmental justice law will become a reality.

In November 2021, President Biden signed into law the Infrastructure Investment and Jobs Act.[311] The Act provides federal funding to states to "repair and rebuild our roads and bridges with a focus on climate change mitigation, resilience, equity, and safety for all users."[312] Funding is also available to clean up legacy pollution in Superfund and brownfield sites, to provide for clean energy

303. Marianne Lavelle, *Trump Rolled Back 100+ Environmental Rules. Biden May Focus on Undoing Five of the Biggest Ones*, INSIDE CLIMATE NEWS (November 17, 2020), https://perma.cc/7DTQ-JQBZ; Press Release, U.S. Senate Committee on Environment and Public Works, Carper Releases New Staff Report on EPA's Pandemic of Pollution (May 20, 2020), https://perma.cc/GQ78-ATS9.

304. *The Federal Response to COVID-19*, USA SPENDING https://perma.cc/D6J9-9LNU (last visited Oct. 29, 2022).

305. Environmental Justice for All Act, H.R. 2021, 117th Cong. (2021).

306. *Id.* § 5

307. *Id.* § 7.

308. *Id.* § 9.

309. *Id.* § 9(c)(1)(A).

310. *Id.* § 21.

311. Public Law 117-58, 135 Stat. 429 (2021).

312. *Fact Sheet: The Bipartisan Infrastructure Deal,* THE WHITE HOUSE (Nov. 6, 2021) https://perma.cc/CG4Z-T73U.

transmission and electric vehicles, and to make communities mores resilient to the impacts of climate change.[313] President Biden's Build Back Better Plan would provide significant federal investments to address climate change and environmental justice and would launch the country toward a clean energy economy.[314] That legislation ultimately failed, but key parts were later incorporated into the Inflation Reduction Act of 2022.[315] The Act provides funding to strengthen resilience to climate change and to accelerate environmental justice efforts in communities that have been overburdened by pollution.[316] The Act created the Greenhouse Gas Reduction Fund to support projects that reduce climate pollution, improve air quality, and promote healthier communities in low-income and disadvantaged communities.[317] It also established an Environmental and Climate Justice Block Grant program to support projects that address persistent pollution challenges in underserved fence line communities.[318] There is a myriad of policy, technological, and cultural changes needed to address health inequities and environmental injustice in society, but curbing harmful emissions is an essential first step. In large part, the sources of greenhouse gas emissions that contribute to climate change are the same sources that create localized pollution hotspots. Thus, comprehensive legislation aimed at curbing greenhouse gas emissions will also serve to address local hotspots. In the absence of federal comprehensive policies to address climate change and environmental justice, there are several actions that can be taken now to address both issues while simultaneously promoting health equity.

A. AMEND THE CAA TO ADDRESS LOCALIZED POLLUTION

One of the more challenging aspects of protecting vulnerable communities from air pollution is the existence of air pollution "hot spots."[319] These are local "microclimates" containing levels of dangerous pollutants that far exceed federal standards under the Clean Air Act.[320] Because NAAQS apply to large geographical areas, the standards are not effective to address significant variations in ambient concentration in air pollution that can exist between locations within a monitoring zone. In some areas, the existing monitoring regime may serve to hide pollution hotspots.[321]

313. *Id.*
314. H.R. 5376, 117th Cong. (as passed by House, Nov. 19, 2021).
315. Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818.
316. *Id.* §§ 60114, 60201
317. *Id.* § 60103.
318. *Id.* § 60201.
319. Carlson, *supra* note 58, at 1036.
320. *Id.* at 1036, 1041.
321. *Id.*

Under the CAA, ambient air quality standards for criteria pollutants must be "requisite to protect the public health" allowing "an adequate margin of error."[322] Similarly, for HAPs, the CAA requires the EPA to evaluate the remaining risk to public health after application of the technology-based standards and to revise the standards, if necessary, to provide an ample margin of safety to protect public health. Despite the CAA's focus on public health and the EPA's acknowledgement of hotspots and the harm they cause, the EPA continues to certify SIPs for compliance with the CAA that fail to address hotspots. Although this is permissible so long as the overall air quality within the air quality control region meets the federal NAAQS and NESHAPS, the failure to account for harmful localized variations in pollution exposes vulnerable populations to pollution burdens that may far exceed safe levels. This violates both the spirit of the CAA and principles of environmental justice. Under the CAA, the EPA Administrator is only required to approve a SIP submission if it complies with the provisions of the CAA.[323] The CAA does not expressly require states to address site-specific, localized pollution in their SIPs.[324] Congress should amend the CAA to require states to identify and address pollution hotspots in their SIPs. Amending the Act is necessary because once the EPA approves a SIP, control measures within the SIP are enforceable in federal court.[325] States already have the tools necessary to identify and address hotspots. Some areas, such as roadways close to major population areas are easily identified. Others requires additional investigation. The EPA developed EJSCREEN, an environmental justice mapping and screening tool, to help identify where to concentrate efforts to combat environmental injustice.[326] EJSCREEN was created in response to President Clinton's historic Executive Order 12898 on environmental justice that instructed all federal agencies to "collect, maintain and analyze information assessing and comparing environmental and human health risks borne by populations identified by race, national origin or income."[327] The tool evaluates eleven environmental indicators and six demographic indicators to identify potential environmental justice issues within an area.[328] Because racial and ethnic minorities are much more likely to live near pollution hotspots, use of EJSCREEN data would help identify

322. 42 U.S.C.§ 7409(a)(2).
323. 42 U.S.C. §7410.
324. *Id.*
325. *Id.*
326. *What is EJSCREEN*, EPA, https://perma.cc/2CJ4-4GPX (last updated Oct. 11, 2022).
327. *Id.*; Exec. Order No. 12898, 59 C.F.R. 7629 (Feb. 16, 1994).
328. *Id.* The environmental indicators include National-Scale Air Toxics Assessment (NATA) air toxics cancer risk, NATA respiratory hazard index, NATA diesel PM, particulate matter, Ozone, traffic proximity and volume, lead paint indicator, proximity to Risk Management Plan (RMP) sites, Proximity to hazardous waste facilities, proximity to National Priorities List (NPL) sites; and a Wastewater Discharge Indicator (Stream Proximity and Toxic Concentration). The demographic indicators include percent low-income, percent people of color, less than high school education, linguistic isolation, individuals under age 5; and individuals over 64. *Id.*

areas where mitigation efforts should be focused.[329] The CAA already requires states to amend their SIPs to add additional control strategies to regions that exceed NAAQS for criteria pollutants, and it requires states to show that they meet federal NESHAPS . By requiring states to address pollution hotspots in their SIPs, Congress would create enforceable standards that both address environmental justice and climate change while promoting health equity. It would also limit the inherently political practice of siting monitors and ensure that all areas of the state are addressed.

B. EXPAND COMMUNITY USE OF HYPERLOCAL AIR QUALITY MONITORING

Traditional air monitoring stations have significant limitations that render data collected of limited value for addressing localized pollution. Air pollution can vary dramatically over short distances. In one study, researchers showed that the level of air pollution was eight times worse on one end of a city block as another.[330] Thus, the placement of traditional monitors along diluted networks across large geographic areas makes it impossible to assess localized pollution. Community air monitoring is a direct response to these limitations. In the 1970s, grassroots environmental activists concerned about exposure to industrial pollutants in fenceline communities formed "bucket brigades" to monitor near-source pollution levels.[331] By capturing and analyzing samples of ambient air in EPA-approved buckets, community members became better informed about the health risks posed by their proximity to emitting entities.[332]

Today, communities utilize a wide variety of measurement tools such as air sensors, passive samplers, remote sensing systems, and other tools to identify local hotspots. One of the most promising technologies is Hyperlocal Air Quality Monitoring ("HAQM").[333] This technology examines data collected from a web of low-cost mobile, stationary, wearable, or robotic air sensors to measure air pollutants at the street level. The data provides a more holistic, high-resolution picture of air quality at the local level and unprecedented details of pollutant concentration at the human exposure level.[334] Such detailed data can lead to targeted action or comprehensive regulatory action and can help develop better health policies.

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329. *Id.*

330. *Understanding Air Pollution in Oakland,* ENV'T DEF. FUND, https://perma.cc/4U3E-4C6W (last visited Oct. 29, 2022).

331. *About The Bucket*, LA. BUCKET BRIGADE https://perma.cc/82V2-9GF4 (last visited Oct. 29, 2022).

332. *Id.*

333. *Hyperlocal Monitoring,* ENV'T DEF. FUND, https://perma.cc/9XQK-YJMP (last visited Oct. 29, 2022).

334. *Id.*

In 2021, New York launched the first statewide air quality initiative that uses Hyperlocal Air Quality Monitoring.[335] Recognizing that "economically disadvantaged communities have also been hit the hardest by the harmful effects of pollution and climate change," the Governor announced that the first stage of the plan would monitor air quality in disadvantaged communities that have been historically overburdened by pollution.[336] The monitoring will include data on greenhouse gas emissions and other pollutants that affect public health.[337] The detailed data received is expected to drive targeted policy decisions that simultaneously address environmental injustice and climate change.[338]

Other states should follow New York's lead to address pollution at the local level in overburdened communities. Doing so will impose new costs on states, but funding is already available. Under its American Rescue Plan, the Biden Administration has committed $100 million for environmental justice grants.[339] This includes $50 million to increase air quality monitoring and $50 million to identify and address disproportionate environmental or public health harms and risks in vulnerable populations.[340] Additional funding may become available under the administration's Justice40 Initiative, which directs agencies across the federal government to invest in low-income and minority communities that have traditionally borne the brunt of pollution.[341] The Inflation Reduction Act of 2022 provides funding for fenceline air monitoring and funding to install air quality sensors in low-income and disadvantaged communities.[342] Thus, there is no justification for failing to take action to assess and address air quality in hotspots.

C. UTILIZE GREEN INFRASTRUCTURE TO ADDRESS ROADWAY AND HEAT ISLAND IMPACTS

Urban environments are significant contributors to global climate change.[343] Urbanization is rapidly increasing at a time when metropolitan areas nationwide are losing approximately 36 million trees every year to development.[344] In many

335. *Governor Hochul Announces New Statewide Community Air Monitoring Initiative, First of Its Kind in the U.S.*, N.Y. STATE (Sept. 21, 2021), https://perma.cc/V5HZ-72CM.

336. *Id.*

337. *Id.*

338. *Id.*

339. American Rescue Plan Act of 2021, Pub. L. No. 117-2, 135 Stat. 4.

340. *Id.*; Press Release, EPA, EPA Announces $50 Million to Fund Environmental Justice Initiatives Under the American Rescue Plan (June 25, 2021), https://www.epa.gov/newsreleases/epa-announces-50-million-fund-environmental-justice-initiatives-under-american-rescue; Press Release, EPA, EPA Announces an Additional $50 Million Under the American Rescue Plan to Enhance Air Pollution Monitoring (July 7, 2021), https://www.epa.gov/newsreleases/epa-announces-additional-50-million-under-american-rescue-plan-enhance-air-pollution.

341. *Justice40*, WHITE HOUSE, https://perma.cc/VS5S-5VEL (last visited Feb. 25, 2023).

342. Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818 § 60105.

343. *Climate Change*, U.N. HABITAT, https://perma.cc/S9YU-ZZWR (last visited Oct. 29, 2022).

344. Richard Conniff, *U.S. Cities Lose Tree Cover Just When They Need It Most,* SCI. AM. (May 7, 2018), https://perma.cc/VKT4-35FB.

areas, the loss of trees is increasing the heat island effect that contribute to heat-related deaths and illnesses.[345]

The role of vegetation in mitigating climate change is well understood. Plants help regulate the climate by sequestering carbon and by offsetting temperature and moisture fluctuations through transpiration.[346] Vegetation can form a barrier around traffic emissions in cities and help mitigate pollution through photosynthetic processes.[347] They can also help reduce heat-related illness by providing shade and cooling the air. Despite these and other health benefits, tree planting programs have not kept pace with tree loss and the declines impact areas most in need of natural barriers. Nationally, tree cover has declined in metropolitan areas across forty-five states.[348]

Studies reveal that exposure to air pollution in urban areas disproportionately impacts racial and ethnic minorities that tend to live and work closest to areas with high traffic volume.[349] Studies also show that discriminatory zoning and redlining policies have left a harmful legacy for certain communities that place them at elevated health risks.[350] In many previously redlined communities, the absence of trees, coupled with the abundance of asphalt and other physical factors such as major roadways and industrial zones, increase the heating effects of climate change. As a result, individuals living in the same city can experience increased local temperature differences from five degrees to twenty degrees Fahrenheit during the summer.[351] Creating green spaces can help cool down areas while passively addressing air pollution.

Under the Infrastructure Investment and Jobs Act, Congress authorized $550 billion in new funding to rebuild roads and bridges, water infrastructure, resilience, internet, and more.[352] The Act authorizes federal funds for the use of "natural infrastructure" in the repair or construction of roadways to promote "resilience."[353] States should use this funding to increase vegetation barriers—trees and plants grown along streets and roads. Such barriers have the potential to reduce air pollution and mitigate the long- and short-term effects of human

345. *Id.*; *see also Heat Island Impacts*, EPA, https://perma.cc/B8N8-PGU9 (last visited Oct. 29, 2022).

346. *See* Yendle Barwise & Prashant Kumar, *Designing Vegetation Barriers for Urban Air Pollution Abatement: A Practical Review for Appropriate Plant Species Selection,* 3 NPJ CLIMATE & ATMOSPHERIC SCI. 12 (2020).

347. *Id.*

348. Conniff, *supra* note 344.

349. Yoo Min Park & Mei-Po Kwan, *Understanding Racial Disparities in Exposure to Traffic-Related Air Pollution: Considering the Spatiotemporal Dynamics of Population Distribution,* 17 INT. J. ENV'T RES. PUB. HEALTH 908, 908 (Feb. 17, 2020).

350. *See, e.g.*, C.B. Swope, et al., *The Relationship of Historical Redlining with Present-Day Neighborhood Environmental and Health Outcomes: A Scoping Review and Conceptual Mode*, 99 J. URBAN HEALTH. 959 (2022).

351. *Urban Heat Island*, CLIMATE CENTRAL (July 14, 2021), https://perma.cc/484J-QEFB.

352. Public Law 117-58, 135 Stat. 429.

353. 23 U.S.C. § 119 (k)(2)(J), (e)(4)(D); *see also* 23 U.S.C. § 101(a)(17), (24).

exposure to pollutants.[354] In addition to reducing pollutants in the air, vegetation buffers can help cool urban heat islands, protect water quality, store carbon, and provide added resilience.[355]

CONCLUSION

The disparate impact of COVID-19 on racial and ethnic minorities has highlighted health inequities and environmental injustice in the United States. Racial and ethnic minorities exposed to high levels of air pollution are more likely to have pre-existing health conditions that increase the risk of infection or death from COVID-19. Climate change is a significant contributor to deteriorating air quality, and its effects will negatively impact public health in ways that make individuals more susceptible to disease. Policymakers must address the climate crisis and environmental injustice with the same urgency with which they have confronted COVID-19. Addressing near-source pollution in overburdened communities is an essential first step. Congress should amend the Clean Air Act to require that all areas within a state meet national air quality standards. Through use of cost-effective Hyperlocal Air Quality Monitoring and vegetation barriers, states can accurately identify pollution hotspots and help mitigate exposure risks in vulnerable communities. Taking these steps will simultaneously address climate change, promote environmental justice, and reduce air pollution-related health risks for all Americans.

354. Walita Kay Williams, *Trees Give Roads a Breath of Fresh Air,* U.S. DEP'T AGRIC (Feb. 21, 2017) https://perma.cc/SSF9-YCZP.

355. *Id.*