ORAL ARGUMENT NOT YET SCHEDULED

No. 24-1087 (and consolidated cases)

UNITED STATES COURT OF APPEALS
FOR THE D.C. CIRCUIT

COMMONWEALTH OF KENTUCKY, et al.,

Petitioners,

v.

ENVIRONMENTAL PROTECTION AGENCY, et al.,

Respondents.

On Petitions for Review of a Final Agency Action of the
United States Environmental Protection Agency
89 Fed. Reg. 27842 (April 18, 2024)

BRIEF OF AMICI CURIAE THE AMERICAN THORACIC SOCIETY, AMERICAN ACADEMY OF FAMILY PHYSICIANS, AMERICAN ACADEMY OF PEDIATRICS, AMERICAN COLLEGE OF PHYSICIANS, AMERICAN MEDICAL ASSOCIATION, ET AL., IN SUPPORT OF RESPONDENTS

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December 6, 2024

CERTIFICATE AS TO PARTIES, RULINGS, AND RELATED CASES

Pursuant to D.C. Circuit Rule 28(a)(1)(A), the American Thoracic Society, American Academy of Allergy, Asthma and Immunology, American Academy of Family Physicians, American Academy of Pediatrics, American Association for Respiratory Care, American College of Chest Physicians, American College of Occupational and Environmental Medicine, American College of Physicians, American Medical Association, International Society for Environmental Epidemiology, National Association of Pediatric Nurse Practitioners, Physicians for Social Responsibility, Society of Critical Care Medicine, and the Medical Society Consortium on Climate and Health submit this certificate as to parties, rulings, and related cases.

(A) Parties and Amici

All parties, intervenors, and *amici* appearing in this Court are listed in the Opening Brief of State Petitioners and the Initial Brief of Respondents.

(B) Rulings Under Review

References to the agency action under review appear in the Opening Brief of State Petitioners and Initial Brief of Respondents.

(C) Related Cases

References to related cases appear in the Opening Brief of State Petitioners and Initial Brief of Respondents.

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CORPORATE DISCLOSURE STATEMENT

Pursuant to Federal Rules of Appellate Procedure 26.1 and 29(a)(4)(A), the American Thoracic Society, American Academy of Allergy, Asthma and Immunology, American Academy of Family Physicians, American Academy of Pediatrics, American Association for Respiratory Care, American College of Chest Physicians, American College of Occupational and Environmental Medicine, American College of Physicians, American Medical Association, International Society for Environmental Epidemiology, National Association of Pediatric Nurse Practitioners, Physicians for Social Responsibility, Society of Critical Care Medicine, and The Medical Society Consortium on Climate and Health state that they do not have parent companies and that no publicly held company has a 10% or greater ownership in any of the organizations.

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D.C. CIRCUIT RULE 29(d) STATEMENT

Counsel for *amici curiae* the American Thoracic Society, American Academy of Allergy, Asthma and Immunology, American Academy of Family Physicians, American Academy of Pediatrics, American Association for Respiratory Care, American College of Chest Physicians, American College of Occupational and Environmental Medicine, American College of Physicians, American Medical Association, International Society for Environmental Epidemiology, National Association of Pediatric Nurse Practitioners, Physicians for Social Responsibility, Society of Critical Care Medicine, and the Medical Society Consortium on Climate and Health certify, pursuant to D.C. Circuit Rule 29(d), that a separate brief is necessary to provide the Court with the perspective and expertise held by the organizations. These *amici* have particular scientific and medical expertise, which is directly relevant to the agency action under review. Thus, *amici curiae*, through counsel, certify that it would not be practicable to file a joint brief in this matter.

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STATEMENT OF INTEREST[1]

The American Thoracic Society is a global medical society and non-profit organization of over 16,000 physicians, scientists, and healthcare professionals dedicated to advancing respiratory health through the detection, prevention, treatment, and cure of diseases, and through education and advocacy. The American Academy of Allergy, Asthma and Immunology, American Academy of Family Physicians, American Academy of Pediatrics, American Association for Respiratory Care, American College of Chest Physicians, American College of Occupational and Environmental Medicine, American College of Physicians, American Medical Association, International Society for Environmental Epidemiology, National Association of Pediatric Nurse Practitioners, Physicians for Social Responsibility, Society of Critical Care Medicine, and the Medical Society Consortium on Climate and Health are non-profit scientific and medical organizations dedicated to public health.

[1] In compliance with the Federal Rule of Appellate Procedure 29(a)(4)(E): no counsel for any party to this litigation authored this brief in whole or in part; no individual or organization, other than *amici* or their counsel, contributed money that was intended to or did fund the preparation or submission of this brief. This brief is filed with a motion to participate as *amici*, in compliance with Federal Rule of Appellate Procedure 29(a)(3).

Amici are concerned about the severe health effects that result from vehicle emissions. This brief describes the public health necessity of regulating and reducing emissions from classes of vehicles through the Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles (the "Standards"), promulgated by the U.S. Environmental Protection Agency ("EPA"). 89 Fed. Reg. 27842 (Apr. 18, 2024). *Amici*'s collective medical, scientific, and clinical expertise leads them to support the implementation of the Standards.

INTRODUCTION AND SUMMARY OF THE ARGUMENT

Air pollution generated by vehicle emissions causes death and disease in people of all ages throughout our nation. Light- and medium-duty vehicles emit substantial quantities of dangerous air pollutants addressed by the Standards, including particulate matter, ozone, nitrogen oxides, sulfur oxides, carbon monoxide, diesel exhaust, volatile organic compounds, air toxics, and greenhouse gases. People breathing polluted air are at risk of experiencing an array of health harms, including respiratory diseases, cardiovascular disease, and cancer. Decades of peer-reviewed research demonstrates these pollutants can both cause and worsen disease, resulting in missed school and workdays, chronic disease burdens, hospitalizations, and premature death. Furthermore, as the largest source of greenhouse gas emissions in the U.S., the transportation sector contributes to

climate change, which compounds these impacts while fomenting its own set of public health harms.

These effects are more severe for certain populations. Children, pregnant people, and the elderly are disproportionately impacted by air pollution because of characteristics inherent to their phase of life that cause them to breathe more frequently or intake greater volumes of air. Other groups of people are disproportionately exposed to air pollutants because of historical and societal factors that influence where they live, work, or go to school.

The Clean Air Act addresses the inseparable link between air pollution and health, establishing that EPA "*shall* by regulation prescribe (and *from time to time revise*) . . . standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines . . . which *may reasonably be anticipated to endanger public health or welfare*." 42 U.S.C. §7521(a)(1) (emphasis added). This mandate creates EPA's obligation to monitor the health and welfare effects of vehicle emissions and update standards if air pollution levels remain unsafe. Although State Petitioners suggest historical emissions standards have done enough—that "today there is no fog for Congress to lift"— the public health data described herein belie that bald declaration. State Pet'rs'. Br. at 1.

EPA responded to the dangers posed by vehicle emissions by promulgating the Standards. In 2055, when the Standards are fully implemented, EPA expects significant reductions of air pollutants, including a 22% reduction of particulate matter, 25% reduction of nitrogen oxides, 46% reduction of volatile organic compounds, 52% reduction in carbon monoxide, and a net greenhouse gas emissions reduction of up to 38%. 89 Fed. Reg. at 27858. These reductions translate into significant improvements in health, saving tens of thousands of lives and providing other respiratory and cardiovascular health benefits.

Over the past several decades, regulations of U.S. vehicle emissions have improved air quality. *Amici* submit this brief to emphasize that despite these improvements, current levels of vehicle-generated air pollution continue to endanger public health and welfare. By reducing emissions of these pollutants, the Standards mitigate harms posed by the dual crises of air pollution and climate change. *Amici* urge the Court to uphold the Standards.

ARGUMENT

I. Exposure to light- and medium-duty vehicle emissions harms public health.

At rest, most adults breathe around six liters of air per minute.[2] Children, pregnant people, the elderly, and those with certain preexisting conditions breathe more frequently or take in larger doses of air.[3] With each breath, humans inhale millions of microscopic particles. Harmful particles regulated by the Standards can penetrate deep into the lungs and can even enter the bloodstream, altering pulmonary, cardiac, immune, and other vital organ systems.[4] 89 Fed. Reg. 27865.

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[2] Joachim D. Pleil et al., *The Physics of Human Breathing: Flow, Timing, Volume, and Pressure Parameters for Normal, On-Demand, and Ventilator Respiration*, 15 J. Breath Rsch. 1, 3 (2021).

[3] Antonella LoMauro & Andrea Aliverti, *Respiratory Physiology of Pregnancy*, 11 Breathe 297, 298 (2015); *see* Arianna Dondi et al., *Outdoor Air Pollution and Childhood Respiratory Disease: The Role of Oxidative Stress*, 24 Int. J. Mol. Sci. 1, 2 (2023); Steven Kesten et al., *Respiratory Rate During Acute Asthma*, 97 Chest 58, 62 (1990).

[4] *See* Zorana J. Andersen et al., *Chronic Obstructive Pulmonary Disease and Long-Term Exposure to Traffic-related Air Pollution: A Cohort Study*, 183 Am. J. Respir. Crit. Care Med. 455, 455–56 (2011). The Standards regulate primary and secondary forms of particulate matter. Primary particulate matter consists of particles emitted directly from a source. Secondary particulate matter, which is more prevalent in the U.S., forms through the chemical reaction of particles including sulfur oxides and nitrogen oxides.

Accordingly, light- and medium-duty vehicle pollution poses persistent threats to public health.[5]

A. Vehicle emissions cause and exacerbate respiratory diseases.

Vehicle emissions can cause and exacerbate respiratory harms such as asthma and chronic obstructive pulmonary disease ("COPD")[6] throughout the human lifespan, from birth into advanced age.[7] An infant's exposure to air pollution can cause asthma later in life: even "[m]odest elevations in exposure to some traffic-related air pollutants during the year of birth are associated with new onset asthma assessed at age 7."[8] And at advanced age, our lungs become more vulnerable to particle pollution. Exposure to pollution from vehicles for those over

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[5] For example, research indicates particulate matter air pollution was the leading contributor to the global disease burden in 2021. *See* Michael Brauer et al., *Global Burden and Strength of Evidence for 88 Risk Factors in 204 Countries and 811 Subnational Locations, 1990–2021: A Systematic Analysis for the Global Burden of Disease Study 2021*, 403 Lancet 2162, 2162 (2024).

[6] Andersen et al., *supra* note 4, at 55–58 (finding an association between exposure to nitrogen oxides and the development of COPD); Monika Nitschke et al., *Lung Function Reductions Associated with Motor Vehicle Density in Chronic Obstructive Pulmonary Disease: A Cross-Sectional Study*, 17 Respir. Res. 1, 1 (2016) ("Vehicle traffic density was associated with significant reductions in lung function in people with COPD.").

[7] *See* Chris Carlsten et al., *Traffic-Related Air Pollution and Incident Asthma in a High-Risk Birth Cohort*, 68 Occup. Environ. Med. 291, 294–95 (2011); Johanna Lepeule et al., *Long-Term Effects of Traffic Particles on Lung Function Decline in the Elderly*, 190 Am. J. Respir. Crit. Care Med. 542, 545 (2014).

[8] Chris Carlsten et al., *supra* note 7 at 291.

sixty-five can result in declining lung function, asthma, COPD, and increased mortality risk.[9]

Once considered only a smoker's disease, researchers have linked COPD to higher residential concentrations of pollutants, including nitrogen oxides, ozone, and particulate matter.[10] A recent eighteen-year study in six U.S. metropolitan regions found a strong association between long-term exposure to ambient air pollutants and increased prevalence of COPD.[11] Further, over forty million Americans already suffer from asthma or COPD, and COPD remains a leading cause of death in the U.S., with no known cure.[12]

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[9] *See* Lepeule et al., *supra* note 7, at 543 (finding exposure to vehicle emissions is associated with worse lung function in the elderly).

[10] *See* EPA, *Integrated Science Assessment for Ozone and Related Photochemical Oxidants*, at IS-8, IS-34, IS-36 (Final Report, 2020) (identifying a causal relationship between ozone exposure and the development of high mortality risk diseases, including asthma and COPD); Joe Devasahayam et al., Chronic Emphysema 1–2 (2023) (ebook). *See also* Meng Wang et al., *Association Between Long-Term Exposure to Ambient Air Pollution and Change in Quantitatively Assessed Emphysema and Lung Function*, 322 JAMA 546, 553 (2019) (recognizing ozone exposure diminishes lung function and increases the risk of lung disease and damage).

[11] *See* Wang et al., *supra* note 10, at 553.

[12] *See* American Lung Association, *COPD in Your State* (last updated Mar. 12, 2024), https://www.lung.org/lung-health-diseases/lung-disease-lookup/copd/for-health-professionals/copd-in-your-state (identifying twelve million people with COPD); Asthma & Allergy Found. of America, *Asthma Facts and Figures* (last updated Sept. 2024), https://aafa.org/asthma/asthma%20facts/ (identifying twenty-

Living near major roadways is a risk factor associated with these poor respiratory outcomes.[13] Children residing closer to major roadways are more likely to have reduced lung function and face a two to three times greater risk of developing asthma than those living further away.[14] The association between time spent near major roadways and development of asthma is especially concerning given "about 10 million students attend public schools within 200 meters of major roads[.]" 89 Fed. Reg. 27878. The outlook is similarly grim for adults living near roads with higher concentrations of particulate matter and nitrogen oxides, who have an increased risk of developing COPD.[15] Vehicle emissions remain a

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eight million people with asthma); John F. Devine, *Chronic Obstructive Pulmonary Disease: An Overview*, 1 Am. Health Drug Benefits 34, 34 (2008).

[13] *See* Health Effects Institute, *Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects*, at i, viii, xv (Jan. 2010), https://www.healtheffects.org/system/files/SR17TrafficReview.pdf (noting traffic emissions are "the principal source of intra-urban variation in the concentrations of air pollutants[.]").

[14] *See* Mary B. Rice et al., *Lifetime Exposure to Ambient Pollution and Lung Function in Children*, 193 Am. J. Respir. Crit. Care Med. 881, 881 (2016); Garrett M. Weaver & W. James Gauderman, *Traffic-Related Pollutants: Exposure and Health Effects Among Hispanic Children*, 187 Am. J. Epidemiology 45, 49 (2018).

[15] *See* Hui-Tsung Hsu et al., *The Effects of Traffic-Related Air Pollutants on Chronic Obstructive Pulmonary Disease in the Community-Based General Population*, 22 Respir. Res. 1, 1 (2021); Andersen et al., *supra* note 4, at 458.

pervasive source of harmful air pollutants, threatening the respiratory health of Americans over their lifespan.

B. Vehicle emissions cause and exacerbate cardiovascular disease.

Vehicle emissions also lead to grave cardiovascular health impacts, including events like heart attack and stroke.[16] Most deaths associated with air pollution exposure are, in fact, attributed to cardiovascular disease.[17] These associations between long-term air pollution exposure and cardiovascular harms are well documented for people living near major roadways.[18] Even short-term

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[16] *See* Annette Peters et al., *Exposure to Traffic and the Onset of Myocardial Infarction*, 351 New Eng. J. Med. 1721, 1721 (2004) ("The time the subjects spent in cars, on public transportation, or on motorcycles or bicycles was consistently linked with an increase in the risk of myocardial infarction."); Wan-Shui Yang et al., *An Evidence-Based Appraisal of Global Association Between Air Pollution and Risk of Stroke*, 175 Int'l J. Cardiology 307, 309 (2014).

[17] Joel D. Kaufman et al., *Guidance to Reduce the Cardiovascular Burden of Ambient Air Pollutants*, 142 Circulation e432, at e433 (2020).

[18] *See* Teagan K. Boehmer et al., *Residential Proximity to Major Highways – United States, 2010*, 62 MMWR Supp. 46, 46 (2013) (finding higher concentrations of air pollutants exist near roads due to traffic); Erin Kulick et al., *Residential Proximity to Major Roadways and Risk of Incident Ischemic Stroke in NOMAS (The Northern Manhattan Study)*, 49 Stroke 835, 835 (2018) (proximity to major roadways is associated with stroke); Cathryn Tonne et al., *A Case-Control Analysis of Exposure to Traffic and Acute Myocardial Infarction*, 115 Environ. Health Perspect. 53, 53 (2007) (concluding the risk of heart attack increased by 5% for those living near major roadways).

exposure to traffic has been linked with increased likelihood of heart attack, particularly for women, people over age sixty, and people with diabetes.[19]

Among all vehicle emissions, particulate matter is especially dangerous for cardiovascular health.[20] An overwhelming body of evidence[21] led to EPA's conclusion that short- and long-term exposures to particulate matter pollution cause adverse cardiovascular effects, such as impaired heart function, hospitalizations for cardiovascular disease and failure, and death.[22] This causal relationship threatens dire consequences in the U.S., where nearly half of adults—over one hundred million Americans—already suffer from cardiovascular disease.[23]

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[19] Peters et al., *supra* note 16, at 1721, 1728 ("An association was found between exposure to traffic and the onset of a myocardial infarction within one hour[.]").

[20] *See* EPA, *Integrated Science Assessment for Particulate Matter*, ES-13 (2019).

[21] *See, e.g.*, Francesca Dominici et al., *Fine Particulate Air Pollution and Hospital Admission for Cardiovascular and Respiratory Diseases*, 295 JAMA 1127, 1127 (2006); Francine Laden et al., *Reduction in Fine Particulate Air Pollution and Mortality*, 173 Am. J. Respir. Crit. Care Med. 667, 667 (2006); C. Arden Pope III et al., *Fine-Particulate Air Pollution and Life Expectancy in the United States*, 360 New Eng. J. Med. 376, 376 (2009).

[22] *See* EPA, *Integrated Science Assessment for Particulate Matter*, *supra* note 20, at ES-13–ES-14.

[23] *See Cardiovascular Diseases Affect Nearly Half of American Adults, Statistics Show*, American Heart Association News (Jan. 31, 2019), https://www.heart.org/en/news/2019/01/31/cardiovascular-diseases-affect-nearly-half-of-american-adults-statistics-show. Cardiovascular disease and stroke

C. Vehicle emissions increase the risk of cancer.

Exposure to vehicle emissions regulated by the Standards also increases cancer risk. In 2013, the World Health Organization characterized outdoor air pollution as "carcinogenic to humans"—a classification that includes substances like tobacco and asbestos.[24] Vehicle emissions are not only a risk factor for urological and breast cancer,[25] but also one of the deadliest forms of cancer: lung

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also burden the U.S. economy. Annual cardiovascular-related healthcare costs are expected to quadruple, nearing $1.5 trillion by 2050. Dhruv S. Kazi et al., *Forecasting the Economic Burden of Cardiovascular Disease and Stroke in the United States Through 2050: A Presidential Advisory From the American Heart Association*, 150 Circulation e89, at e89 (2024).

[24] Press Release, International Agency for Research on Cancer, *IARC: Outdoor Air Pollution a Leading Environmental Cause of Cancer Deaths* (Oct. 17, 2013), https://www.iarc.who.int/wp-content/uploads/2018/07/pr221_E.pdf; International Agency for Research on Cancer, *List of Classifications* (last updated Nov. 29, 2024), https://monographs.iarc.who.int/list-of-classifications/.

[25] *See* Jinhui Li et al., *Ambient Air Pollution and Urological Cancer Risk: A Systematic Review and Meta-Analysis of Epidemiological Evidence*, 15 Nature Comm. 1, 2 (2024) (finding increased exposure to particulate matter or nitrogen dioxide increases risk of urological cancers); Alexandra J. White et al., *Ambient Fine Particulate Matter and Breast Cancer Incidence in a Large Prospective US Cohort*, 116 J. Nat'l Cancer Inst. 53, 55 (2024) (increased particulate matter exposure is associated with risk of breast cancer).

cancer, which has a five-year survival rate of only 26.7%.[26] After smoking, air pollution is a leading cause of lung cancer.[27]

Volumes of longstanding scientific literature establish the causal connection between lung cancer and exposure to two vehicle pollutants: particulate matter and diesel exhaust.[28] A 2014 study with over 100,000 participants found that lung cancer risk rose as particulate matter exposure increased.[29] Notably, one of the strongest correlations was identified among participants who had never smoked, demonstrating an independent relationship between exposure to particulate matter and an increased risk of lung cancer.[30]

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[26] Iona Cheng et al., *Traffic-Related Air Pollution and Lung Cancer Incidence: The California Multiethnic Cohort Study*, 206 Am. J. Respir. Crit. Care Med. 1008, 1014 (2022); *Cancer Stat Facts: Common Cancer Sites*, National Cancer Institute, https://seer.cancer.gov/statfacts/html/common.html (last visited Nov. 27, 2024).

[27] Renelle Myers et al., *High-Ambient Air Pollution Exposure Among Never Smokers Versus Ever Smokers With Lung Cancer*, 16 J. Thoracic Oncology 1850, 1850 (2021).

[28] *See* Cheng et al., *supra* note 26; Robin C. Puett et al., *Particulate Matter Air Pollution Exposure, Distance to Road, and Incident Lung Cancer in the Nurses' Health Study Cohort*, 122 Env't Health Perspect. 926, 929 (2014). *See also* EPA, *Integrated Science Assessment for Particulate Matter*, at 10-1 (recognizing a "likely to be causal" relationship between particulate matter exposure and lung cancer); EPA, *Integrated Risk Information System Chemical Assessment Summary: Diesel Engine Exhaust* 11 (last updated Feb. 28, 2003) (characterizing diesel exhaust as "likely to be carcinogenic to humans" in 1999).

[29] *See* Puett et al., *supra* note 28, at 929.

[30] *Id.* at 931.

Diesel-fueled light- and medium-duty vehicles present distinctive harms, given the mixture of toxic pollutants contained in diesel exhaust.[31] The causal relationship between exposure to diesel exhaust and increased lung cancer risk is especially concerning for people in certain occupations, such as toll booth workers, construction workers, and truck drivers, who are chronically exposed to these emissions for prolonged periods.[32] The Standards will mitigate the health effects of these carcinogenic pollutants.

II. Exposure to light- and medium-duty vehicle emissions disproportionately harms the health of vulnerable and historically disadvantaged populations.

Health harms from vehicle emissions are not evenly distributed among people in the U.S.[33] Children are uniquely susceptible to health harms from vehicle

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[31] *See* Rajiv Bhatia et al., *Diesel Exhaust Exposure and Lung Cancer*, 9 Epidemiology 84, 84, 87 (1998) (finding a 33% increased risk of lung cancer from diesel exhaust exposure across twenty-three studies).

[32] *Id.* at 84. *See also* Eric Garshick et al., *Lung Cancer and Elemental Carbon Exposure in Trucking Industry Workers*, 120 Env't Health Perspect. 1301, 1304 (2012) (finding truckers exposed to diesel exhaust face an increased risk of mortality from lung cancer); American Cancer Society, *Diesel Exhaust and Cancer Risk* (last updated Feb. 26, 2024), https://www.cancer.org/cancer/risk-prevention/chemicals/diesel-exhaust-and-cancer.html (highlighting that occupations with the highest diesel exhaust exposures also include firefighters, mechanics, and garage workers).

[33] *Supra* Part I.A.

emissions because of their elevated respiratory rate and time spent outdoors in play or exercise, resulting in a higher inhaled dose of air pollution.[34] Moreover, racially and ethnically diverse and socioeconomically disadvantaged communities are more likely to be exposed to and harmed by vehicle emissions at home, school, and work.[35] The Clean Air Act requires EPA to regulate vehicle emissions that endanger the public, which includes these groups of people disproportionately at risk of harm.

A. Vehicle emissions disproportionately harm children.

Each year, millions of children are at risk of experiencing acute symptoms from conditions caused or worsened by exposure to pollutants regulated by the Standards.[36] The largest multi-city U.S. study of respiratory emergency department visits found that children were twice as likely as adults to seek emergency care following short-term exposures to ozone or particulate matter.[37] Because children

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[34] *See* Dondi et al., *supra* note 2, at 2; Heather M. Strosnider et al., *Age-Specific Associations of Ozone and Fine Particulate Matter with Respiratory Emergency Department Visits in the United States*, 199 Am. J. Crit. Care Med. 882, 885 (2019) ("[Age] influences respiratory tract morphology, breathing patterns, physiochemical properties of the extracellular lining fluid, immunologic responses, and mechanical properties of the lung.").

[35] *Infra* Part II.B.

[36] *See e.g.*, Strosnider et al., *supra* note 34, at 885.

[37] *Id.* at 885–89.

breathe larger doses of particulate matter, they are more vulnerable to a variety of short- and long-term health consequences, including asthma, COPD, cancer, fibrosis, and other bacterial and viral infections.[38]

The impacts of air pollution reach far beyond children's physical health. For example, asthma is one of the most expensive childhood diseases, due largely to the cost of hospitalizations and emergency department visits.[39] Asthma also impairs children's ability to thrive in the classroom, leading to increased school absenteeism[40] and negative cognitive impacts that can harm academic performance.[41] Improvements to air quality resulting from the Standards will

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[38] *See* Dondi et al., *supra* note2, at 2; Jason Ma et al., *Fine Particulate Matter Manipulates Immune Response to Exacerbate Microbial Pathogenesis in the Respiratory Tract*, 33 Eur. Respir. Rev. 1, 4–6 (2024).

[39] *See* Kelly Moore et al., *Ambient Ozone Concentrations Cause Increased Hospitalizations for Asthma in Children: An 18-Year Study in Southern California* 116 Environ. Health Perspect. 1063, 1063 (2008). *See also* Richard Perry et al., *The Economic Burden of Pediatric Asthma in the United States: Literature Review of Current Evidence*, 37 PharmacoEconomics 155, 155 (2018) (assessing $5.92 billion in direct costs from pediatric asthma in 2013); Patrick Sullivan et al., *School Absence and Productivity Outcomes Associated with Childhood Asthma in the USA*, 55 J. Asthma 161, 165 (2018) (finding childhood asthma led to adult caregivers missing 16% more work days).

[40] Sara B. Johnson et al., *Asthma and Attendance in Urban Schools*, 16 Prev. Chronic Dis. 1, 1 (2019) (concluding childhood asthma caused between 14% and 18% of school absenteeism among over 1,000 students studied).

[41] Pak Hung Lam et al., *Long-Term Exposure to Fine Particulate Matter and Academic Performance Among Children in North Carolina*, 6 JAMA Netw. Open 1, 3 (2023) (showing a "significant negative association of long-term [particulate

benefit children[42] and other vulnerable populations that disproportionately suffer from exposure to vehicle emissions. 89 Fed. Reg. at 28118, 28143.

B. Vehicle emissions disproportionately harm racially and ethnically diverse and socioeconomically disadvantaged populations.

Racially and ethnically diverse and socioeconomically disadvantaged communities shoulder disproportionate harms from vehicle emissions.[43] These communities often live closer to major roadways, resulting in more frequent and

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matter] exposure with children's academic performance, especially among female students, students with low family income, and students with minority race or ethnicity."); Ramesh N. Annavarapu & Srujana Kathi, *Cognitive Disorders in Children Associated with Urban Vehicular Emissions*, 208 Environ. Pollut. 74, 75 (2016).

[42] James W. Gauderman et al., *Association of Improved Air Quality with Lung Function Development in Children*, 372 New. Eng. J. Med. 905, 910 (2015) (recognizing long-term improvements in air quality are associated with improved lung function in children).

[43] *See* Christopher W. Tessum et al., *PM2.5 Polluters Disproportionately and Systemically Affect People of Color in the United States*, 7 Sci. Advances 1, 6 (2021) (identifying light-duty vehicle emissions of particulate matter as the second greatest cause of exposure disparity between White individuals and persons of color in the U.S.); 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) ("Blacks and Hispanics on average bear a 'pollution burden' of 56% and 63% excess exposure, respectively, relative to the exposure caused by their consumption [of goods and services].").

severe health impacts because of increased exposure to vehicle emissions.[44] A national study of short-term particulate matter exposure found non-White people were more likely than White people to have greater than average exposure.[45] Another study confirmed that racially and socioeconomically segregated neighborhoods, concentrated near major roadways, experienced nearly eight times the risk of cancer from traffic-related air pollution.[46]

Proximity to roads among certain groups is tethered to historical factors, such as redlining policies, that shaped current residence and roadway patterns.[47] From the 1930s to the 1970s, the Home Owners' Loan Corporation appraised neighborhoods with a higher proportion of racial minorities as unfavorable for mortgages, increasing segregation and depressing property values in these redlined

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[44] Weaver & Gauderman, *supra* note 14, at 49 (finding Hispanic children living within 75 meters of a major non-freeway road were over twice as likely to report developing asthma than those living farther away).

[45] Timothy Collins & Sara Grineski, *Racial/Ethnic Disparities in Short-Term PM2.5 Air Pollution Exposures in the United State*s, 130 Environ. Health Perspect. 1, 1 (2022).

[46] Emily B. White & Christine C. Ekenga, *Multidimensional Structural Racism and Estimated Cancer Risk from Traffic-Related Air Pollution*, 130 Cancer 3699, 3703 (2024).

[47] *See* Kyung Hwa Jung et al., *Home and School Pollutant Exposure, Respiratory Outcomes, and Influence of Historical Redlining*, 154 J. Allergy Clin. Immunol. 1159, 1165 (2024) (finding children in historically redlined neighborhoods lived closer to major highways and experienced higher nitrogen dioxide exposure).

neighborhoods.[48] This led to the development of industry and construction of major roadways in these communities.[49] Due to this proximity, formerly redlined areas in cities studied nationwide faced higher than average exposure to vehicle pollutants such as nitrogen dioxide.[50] Thus, worse redlining grades correlate with increased incidence of asthma and 2.4 times more frequent asthma-related emergency department visits.[51]

Even when exposed to vehicle emissions at the same level as other populations, racially and ethnically diverse and socioeconomically disadvantaged communities experience more severe health outcomes. Black and socioeconomically disadvantaged communities face a higher risk of death from

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[48] *See* Haley M. Lane et al., *Historical Redlining Is Associated with Present-Day Air Pollution Disparities in U.S. Cities*, 9 Environ. Sci. & Technol. Lett. 345, 345, 347 (2022).

[49] *Id.* (noting the legacies of discrimination, including redlining and land-use policies, have resulted in the concentration of pollution sources like highways, in "diverse communities").

[50] *Id.* at 346–47.

[51] Alexander J. Schuyler & Sally E. Wenzel, *Historical Redlining Impacts Contemporary Environmental and Asthma-Related Outcomes in Black Adults*, 206 Am. J. Respir. Crit. Care Med. 824, 828–29 (2022) (finding adults in redlined neighborhoods experienced increased uncontrolled or severe asthma); 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 Planet. Health, e24, at e27–e28 (2020).

vehicle pollutants such as particulate matter.[52] This difference in health outcomes may be attributed to factors such as "lack of access to healthcare, racialized occupational sorting into jobs with more hazardous exposures, and other social and structural determinants of health."[53] These health risks are compounded by the effects of our increasingly warming world, as described below.[54]

III. Vehicle emissions disrupt the climate in multiple ways that harm public health.

In addition to the direct human health harms described above, light- and medium-duty vehicles emit greenhouse gases that threaten public health by increasing the frequency and intensity of extreme weather events—hurricanes,

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[52] Qian Di et al., *Air Pollution and Mortality in the Medicare Population*, 376 New Eng. J. Med. 2513, 2518 (2017) (identifying a three times greater risk of death for Black individuals compared to the general population when faced with equal increases in long-term particulate matter exposure); *see also* Benjamin Bowe et al., *Burden of Cause-Specific Mortality Associated With $PM_{2.5}$ Air Pollution in the United States*, 2 JAMA Netw. Open 1, 10 (2019).

[53] Pascal Geldsetzer et al., *Disparities in Air Pollution Attributable Mortality in the US Population by Race/Ethnicity and Sociodemographic Factors*, 30 Nat. Med. 2821, 2822 (2024). *See also* Anjum Hajat et al., *Socioeconomic Disparities and Air Pollution Exposure: A Global Review*, 2 Curr. Environ. Health Rep. 440, 441 (2015) (noting under-resourced communities may have increased susceptibility to poor health from stressors such as "discrimination and chronic stress, fewer opportunities to choose health-promoting behaviors and poorer health status[.]").

[54] John Balbus et al., *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*, U.S. Global Change Research Program 43 (2016).

floods, heat waves, severe droughts—lengthening the pollen season, increasing dust storms, and contributing to the spread of disease.[55] Rising average global temperatures and extreme heat events alone present numerous health harms.

Elevated concentrations of greenhouse gases from sources including light- and medium-duty vehicles trap a higher portion of the sun's heat that the Earth radiates back into space, raising global land and ocean temperatures.[56] August 2024 marked the fifteenth consecutive month of record-breaking average global temperatures.[57] The ten hottest years on record all have occurred since 2015.[58] Light- and medium-duty vehicles that run on fossil fuel combustion make up the majority of greenhouse gas emissions within the transportation sector, which is the

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[55] *Id.*

[56] *See, e.g.*, EPA, *Causes of Climate Change* (last visited Dec. 3, 2024), https://www.epa.gov/climatechange-science/causes-climate-change.

[57] *See* National Oceanic and Atmospheric Association, *Earth Had its Hottest August in 175-Year Record* (last updated Sept. 12, 2024), https://www.noaa.gov/news/earth-had-its-hottest-august-in-175-year-record; Andrea Thompson, *The Summer of 2023 Was the Hottest in 2,000 Years*, Sci. Am. (May 14, 2024), https://www.scientificamerican.com/article/the-summer-of-2023-was-the-hottest-in-2-000-years/.

[58] *See* Climate Copernicus, *New Record Daily Global Average Temperature Reached in July 2024* (July 25, 2024), https://climate.copernicus.eu/new-record-daily-global-average-temperature-reached-july-2024#.

largest source of U.S. greenhouse gas emissions.[59] And U.S. vehicle use is only predicted to grow.[60]

If these trends persist as predicted, so too will the resulting health impacts, including the effects of extreme heat.[61] In 2023 alone, over 2,300 people died from heat-related causes—a statistic orders of magnitude higher than decades prior.[62]

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[59] *See* EPA, *Fast Facts on Transportation Greenhouse Gas Emissions 1990-2022* (May 2024), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P101AKR0.pdf.

[60] *See* Office of Highway Policy Information, *FHWA Forecasts of Vehicle Miles Traveled (VMT): Spring 2024*, Federal Highway Administration (June 2024), https://www.fhwa.dot.gov/policyinformation/tables/vmt/2024_vmt_forecast_sum.pdf.

[61] U.S. Global Change Research Program, *Fifth National Climate Assessment* at 1–17 (2023) ("In the 1980s, the country experienced, on average, one (inflation-adjusted) billion-dollar disaster every four months. Now, there is one every three weeks, on average. Between 2018 and 2022, the US experienced 89 billion-dollar events."). *See also* Calum X. Cunningham et al., *Increasing Frequency and Intensity of the Most Extreme Wildfires on Earth*, 8 Nat. Ecol. Evol. 1420, 1420 (2024).

[62] *See* U.S. Department of Health and Human Services, *Extreme Heat* (last updated Nov. 5, 2024), https://www.hhs.gov/climate-change-health-equity-environmental-justice/climate-change-health-equity/climate-health-outlook/extreme-heat/index.html (finding increased temperatures are linked to numerous adverse health effects, including heat exhaustion, heat stroke, dehydration, and exacerbation of preexisting mental health, neurological, and cardiovascular conditions, which can result in death); Kate R. Weinberger et al., *Estimating the Number of Excess Deaths Attributable to Heat in 297 United States Counties*, 4 Environ. Epidemiol. 1, 2 (2020); Jeffrey T. Howard et al., *Trends of Heat-Related Deaths in the US, 1999-2023*, 332 JAMA 1203, 1203 (2024) (identifying just 311 heat-related deaths in 2004).

Thousands to tens of thousands of premature heat-related deaths are projected per year by 2100 in the U.S. alone.[63] Other heat-related health harms include heat stroke,[64] preterm birth, low birth weight, and stillbirth,[65] and decreased lung function.[66]

Higher temperatures also increase atmospheric quantities of two dangerous air pollutants: ozone and particulate matter.[67] Ozone is formed when the nitrogen

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[63] *See* Balbus et al., *supra* note 54.

[64] *See* R. Sari Kovats & Shakoor Hajat, *Heat Stress and Public Health: A Critical Review*, 29 Annu. Rev. Public Health 41, 42, 47 (2008); Helene G. Margolis, *Heat Waves and Rising Temperatures: Human Health Impacts and the Determinants of Vulnerability*, *in* Global Climate Change and Public Health, 85, 97–100 (Kent E. Pinkerton & William N. Rom eds. 2014).

[65] *See* Bruce Bekkar et al., *Association of Air Pollution and Heat Exposure With Preterm Birth, Low Birth Weight, and Stillbirth in the US: A Systematic Review*, 3 JAMA Netw. Open 1, 1 (2020); Rachel B. Smith et al., *Impact of London's Road Traffic Air and Noise Pollution on Birth Weight: Retrospective Population Based Cohort Study*, 359 BMJ 1, 11 (2017) (finding those inhaling ambient air pollution may give birth to premature and low birth weight infants).

[66] *See* Mary B. Rice et al., *Association of Outdoor Temperature with Lung Function in a Temperate Climate*, 53 Eur. Respir. J. 1, 1 (2019) (observing higher average temperatures are associated with lower lung function).

[67] *See* Tim Osborn, *The Interplay of Climate Change and Air Pollution on Health*, 10 J. Climatol. Weath. Forecast. 1, 1 (2022); D.J. Rasmussen et al., *The Ozone-Climate Penalty: Past, Present, and Future*, 47 Environ. Sci. Technol. 14258, 14258 (2013); American Lung Association, *Road to Clean Air* (2020), https://www.lung.org/getmedia/99cc945c-47f2-4ba9-ba59-14c311ca332a/electric-vehicle-report.pdf at 3 (noting roughly half of Americans live in counties with unhealthy levels of ozone or particulate matter, making these pollutants the most widespread in the United States).

oxides and volatile organic compounds emitted by vehicles react with sunlight and heat.[68] Ozone causes respiratory harms, cardiovascular disease, metabolic disease, and premature death.[69] Heat and other changes in climate accelerated by vehicle emissions also cause earlier snowmelt, create drier conditions, and expand burn areas for forest fires, resulting in more intense and frequent wildfires.[70] Indeed, wildfires now account for over half of total particulate matter pollution in the U.S.,[71] contributing further to cardiovascular and respiratory complications and premature death.[72]

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[68] *See* Rasmussen et al., *supra* note 67, at 14258; *Road to Clean Air*, *supra* note 67, at 3.

[69] *See generally* EPA, *Integrated Science Assessment for Ozone and Related Photochemical Oxidants*, *supra* note 10.

[70] *See* Mu Xiao, *A Warning of Earlier Snowmelt*, 11 Nat. Clim. Change 380, 380 (2021); Chantelle Burton et al., *Global Burned Area Increasingly Explained by Climate Change*, 14 Nat. Clim. Change 1186, 1186 (2024).

[71] *See* Marissa L. Childs et al., *Daily Local-Level Estimates of Ambient Wildfire Smoke $PM_{2.5}$ For the Contiguous US*, 56 Environ. Sci. & Techol. 13607, 13613 (2022).

[72] *See* Cunningham et al., *supra* note 61, at 1421–23 (finding the frequency and severity of wildfires has doubled within the past two decades); Kaufman et al., *supra* note 17.

IV. Regulation is an effective means of improving air quality, while generating welfare benefits such as healthcare cost savings and economic growth.

Regulations that limit vehicle emissions are effective measures for improving air quality. Despite growth in population and on-road travel, vehicle pollution controls under the Clean Air Act have resulted in markedly cleaner air in U.S. cities.[73] Analyzing the effectiveness of California's emissions regulations, researchers concluded that policies targeting on-road mobile emissions were the "single most important element for observed improvements in the Los Angeles region."[74] Although vehicle activity increased by 38% in the areas studied, pollutant emissions decreased.[75] Because light- and medium-duty vehicles

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[73] *See* EPA, *Accomplishments and Successes of Reducing Air Pollution from Transportation in the United States* (last updated Aug. 20, 2024), https://www.epa.gov/transportation-air-pollution-and-climate-change/accomplishments-and-successes-reducing-air; EPA, *The Benefits and Costs of the Clean Air Act from 1990 to 2020: Final Report – Rev. A*. (Apr. 2011), https://www.epa.gov/sites/default/files/2015-07/documents/summaryreport.pdf.

[74] Fred Lurmann et al., *Emissions Reduction Policies and Recent Trends in Southern California's Ambient Air Quality*, 65 J. Air Waste Manage. Assoc. 324, 324 (2015).

[75] *Id.*

significantly contribute to U.S. air pollution,[76] the Standards' reductions are critical for improving air quality.[77]

Research suggests *any* reductions in particulate matter, even in areas with already low concentrations of this pollutant, continue to provide health benefits.[78] A study of 545 U.S. counties estimated that air pollution controls reducing particulate matter accounted for 18% of recorded increases in life over a seven-year period.[79] Another study reviewed the impacts of tightening vehicle emissions regulations in the U.S. over ten years, and estimated that traffic pollution-related mortality was 2.4 times lower under stricter standards.[80] Myriad studies support the

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[76] *See* EPA, *Fast Facts on Transportation Greenhouse Gas Emissions 1990-2022*, *supra* note 59.

[77] *See* Nicholas A. Mailloux et al., *Nationwide and Regional $PM_{2.5}$-Related Air Quality Health Benefits From the Removal of Energy-Related Emissions in the United States*, 6 GeoHealth 1, 10 (2022) (estimating removing particulate matter emissions from vehicles in the U.S. would prevent 11,700 premature deaths annually).

[78] Andrew W. Correia et al., *Effect of Air Pollution Control on Life Expectancy in the United States: An Analysis of 545 U.S. Counties for the Period From 2000 to 2007*, 24 Epidemiology 23, 30 (2013).

[79] *Id.* at 27.

[80] Ernani F. Choma et al., *Health Benefits of Decreases in On-Road Transportation Emissions in the United States From 2008 to 2017*, 118 Proc. Nat'l Acad. Sci. 1, 2 (2021).

same conclusion: Regulations that curtail emissions lead to better health outcomes.[81]

These public health gains result in substantial welfare benefits. Air pollution exacerbates symptoms of respiratory, cardiovascular, and other diseases, leading to increased rescue medication use, school and work absences, emergency room visits, and hospitalizations.[82] These outcomes physically but also financially burden individuals, families, healthcare systems, and the U.S. economy.[83] Because

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[81] *See, e.g.,* Mary D. Willis et al., *Assessing the Effectiveness of Vehicle Emission Regulations on Improving Perinatal Health: A Population-Based Accountability Study*, 49 Int. J. Epidemiol. 1781, 1787–88 (2020) (finding regulatory efforts to reduce traffic-related air pollution in Texas directly benefited infant health); Armistead G. Russell et al., *Impacts of Regulations on Air Quality and Emergency Department Visits in the Atlanta Metropolitan Area, 1999-2013*, 195 Res. Rep. Health Eff. Inst. 1, 7 (2018) (measuring 16.5% reduction in asthma-related emergency department visits in Atlanta when pollution-control policies were fully implemented); Scott Samuelsen et al., *An Episodic Assessment of Vehicle Emission Regulations on Saving Lives in California*, 55 Environ. Sci Technol. 547, 550 (2021) (concluding regulation of combustion vehicles avoided many severe health impacts).

[82] *See* George D. Thurston et al., *Outdoor Air Pollution and New-Onset Airway Disease*, 17 Ann. Am. Thorac. Soc. 387, 388 (2020); Sullivan et al., *supra* note 39.

[83] *See* Choma et al., *supra* note 80 (estimating reducing on-road emissions saved $270 billion in air pollution-related mortality costs in 2017); *supra* Kazi et al., note 23, Perry et al., and Sullivan et al., note 39 and accompanying text; Tursynbek Nurmagambetov et al., *The Economic Burden of Asthma in the United States, 2008–2013*, 15 Ann. Am. Thorac. Soc. 348, 348 (2018) (estimating U.S. asthma-related economic burden in 2013 was $81.9 billion); American Lung Association, *COPD Trends Brief: Burden* (last accessed Dec. 3, 2024), https://www.lung.org/research/trends-in-lung-disease/copd-trends-brief/copd-

diseases such as asthma and COPD are chronic conditions, these economic and social costs persist over an individual's lifespan.[84]

Petitioners and their *amici* frame the Standards as a net burden on Americans, in part due to the potential for higher vehicle purchase prices. State Pet'rs'. Br. at 10. This framing is misleading. It ignores the staggering monetary, morbidity, and mortality-related price of vehicle emissions described herein. The health and welfare benefits the Standards will generate through air quality improvements will provide significant cost savings for the public, foster economic growth by decreased absenteeism from school and work, and improve health essential to participate meaningfully in economic activity.[85] Studies of the benefits and costs of the Clean Air Act over decades consistently demonstrate the return on

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burden (estimating direct medical cost of COPD to be $24 billion annually for adults forty-five and older).

[84] Monetary estimates may undervalue the welfare benefits associated with reducing these burdens, as avoided pain and suffering are not monetized. *See* EPA, *Regulatory Impact Analysis: Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles*, Docket EPA-420-R-24-004 at 6-53 (March 2024), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1019VPM.pdf.

[85] *See, e.g.,* Jeetvan G. Patel et al., *COPD Affects Worker Productivity and Health Care Costs*, 13 Int. J. Chron. Obstruct. Pulmon. Dis. 2301, 2302, 2308 (2018) (finding reduced lung function negatively impacts productivity through missed workdays and impaired performance).

investment in public health.[86] Pursuant to its statutory mandate, EPA promulgated the Standards in response to evidence that vehicle emissions continue to endanger public health and welfare.

CONCLUSION

Our nation's health and welfare demand more protective vehicle emissions regulations. The Clean Air Act requires EPA to set standards that protect the public from harms associated with vehicle emissions, and the Standards respond to that requirement. For the reasons above, the Court should uphold the Standards.

Respectfully submitted,

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[86] EPA, *The Benefits and Costs of the Clean Air Act from 1990 to 2020: Final Report* – Rev. A, *supra* note 73.

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CERTIFICATE OF COMPLIANCE

This brief complies with the word limitation of Federal Rules of Appellate Procedure 29(a)(5) and 32(a)(7)(B). The brief contains 6,474 words, excluding portions exempted by Federal Rule of Appellate Procedure 32(f) and D.C. Circuit Rule 32(e)(1).

This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the typestyle requirements of Federal Rule of Appellate Procedure 32(a)(6). The brief has been prepared in proportionally spaced typeface using Microsoft Word and 14-point Times New Roman font.

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CERTIFICATE OF SERVICE

I hereby certify that on December 6, 2024, a copy of the foregoing brief was served on all registered counsel through the D.C. Circuit's electronic filing (CM/ECF) system.

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