ORAL ARGUMENT NOT YET SCHEDULED

No. 22-1031 and consolidated cases

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

STATE OF TEXAS, et al.,
Petitioners,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, et al.,
Respondents.

On Petition for Review of Final Action by the United States Environmental Protection Agency

---

BRIEF OF *AMICI CURIAE* THE AMERICAN THORACIC SOCIETY, AMERICAN MEDICAL ASSOCIATION, AMERICAN PUBLIC HEALTH ASSOCIATION, AMERICAN COLLEGE OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE, AMERICAN ACADEMY OF PEDIATRICS, AMERICAN ASSOCIATION FOR RESPIRATORY CARE, CLIMATE PSYCHIATRY ALLIANCE, AMERICAN COLLEGE OF PHYSICIANS, AMERICAN COLLEGE OF CHEST PHYSICIANS, ACADEMIC PEDIATRIC ASSOCIATION, AND AMERICAN ACADEMY OF ALLERGY, ASTHMA AND IMMUNOLOGY

Sara A. Colangelo
Jack H.L. Whiteley
Lindsay A. Bailey
Environmental Law & Justice Clinic
Georgetown University Law Center
600 New Jersey Avenue, NW
Washington, D.C. 20001-2075
Counsel for Amici Curiae

Dated: March 3, 2023

CERTIFICATE AS TO PARTIES, RULINGS UNDER REVIEW, AND RELATED CASES

Pursuant to Circuit Rule 28(a)(1), *amici curiae* the American Thoracic Society, American Medical Association, American Public Health Association, American College of Occupational and Environmental Medicine, American Academy of Pediatrics, American Association for Respiratory Care, Climate Psychiatry Alliance, American College of Physicians, American College of Chest Physicians, Academic Pediatric Association, and American Academy of Allergy, Asthma and Immunology, through undersigned counsel, hereby certify as follows:

(A) **Parties and Amici.** All parties, intervenors, and amici appearing in this Court are listed in the State Petitioners' Brief.

(B) **Rulings Under Review.** The consolidated petitions before the Court challenge the action of the U.S. Environmental Protection Agency published as "Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards," published at 86 Fed. Reg. 74,434 (Dec. 30, 2021).

(C) **Related Cases.** *Amici curiae* are not aware of any related cases other than the consolidated cases before the Court.

Dated: March 3, 2023

/s/ Sara A. Colangelo
Sara A. Colangelo

CORPORATE DISCLOSURE STATEMENT

Pursuant to Circuit Rule 26.1 and Federal Rule of Appellate Procedure 26.1, undersigned counsel certifies that the American Thoracic Society, American Medical Association, American Public Health Association, American College of Occupational and Environmental Medicine, American Academy of Pediatrics, American Association for Respiratory Care, Climate Psychiatry Alliance, American College of Physicians, American College of Chest Physicians, Academic Pediatric Association, and American Academy of Allergy, Asthma and Immunology are not-for-profit public health and scientific organizations. *Amici curiae* do not have parent corporations and no publicly held corporation has ownership of 10 percent or greater in the American Thoracic Society, American Medical Association, American Public Health Association, American College of Occupational and Environmental Medicine, American Academy of Pediatrics, American Association for Respiratory Care, Climate Psychiatry Alliance, American College of Physicians, American College of Chest Physicians, Academic Pediatric Association, or the American Academy of Allergy, Asthma and Immunology. *Amici curiae* do not have any members who have issued shares or debt securities to the public.

Dated: March 3, 2023

/s/ Sara A. Colangelo
Sara A. Colangelo
Environmental Law & Justice Clinic
Georgetown University Law Center

600 New Jersey Avenue, NW
Washington, DC 20001-2075
Counsel for Amici Curiae

D.C. CIRCUIT RULE 29(d) STATEMENT

Counsel for *amici curiae* the American Thoracic Society, American Medical Association, American Public Health Association, American College of Occupational and Environmental Medicine, American Academy of Pediatrics, American Association for Respiratory Care, Climate Psychiatry Alliance, American College of Physicians, American College of Chest Physicians, Academic Pediatric Association, and American Academy of Allergy, Asthma and Immunology certifies, pursuant to Circuit Rule 29(d), that a separate brief is necessary to provide the Court with the perspective and expertise of public health professionals that *amici curiae* represent. The targeted focus of the *amici* on public health is uniquely relevant to the agency action at issue. Accordingly, *amici curiae*, through counsel, certify that filing a joint brief would not be practicable.

Dated: March 3, 2023

/s/ Sara A. Colangelo
Sara A. Colangelo
Environmental Law & Justice Clinic
Georgetown University Law Center
600 New Jersey Avenue, NW
Washington, D.C. 20001-2075
Counsel for Amici Curiae

TABLE OF CONTENTS

PAGE

TABLE OF AUTHORITIES

Statutes

Regulations

Agency and Executive Materials

Legislative Materials

Other Authorities

GLOSSARY

EPA: Environmental Protection Agency

STATUTES AND REGULATIONS

Pertinent statutes and regulations are contained in the addendum to the Brief for Respondents.

STATEMENT OF IDENTITY, INTEREST IN CASE, AND SOURCE OF AUTHORITY TO FILE[1]

The American Thoracic Society is an international non-profit organization of more than 16,000 physicians, scientists, and healthcare professionals dedicated to the detection, prevention, treatment, and cure of respiratory disease, critical care illnesses, and sleep-disordered breathing. The American Medical Association, American Public Health Association, American College of Occupational and Environmental Medicine, American Academy of Pediatrics, American Association for Respiratory Care, Climate Psychiatry Alliance, American College of Physicians, American College of Chest Physicians, Academic Pediatric Association, and American Academy of Allergy, Asthma and Immunology are non-profit scientific and medical organizations dedicated to the protection of public health.

Together, *amici* are concerned about the severe health effects that result from vehicle emissions. These impacts include respiratory and cardiovascular

---

[1] In compliance with Federal Rule of Appellate Procedure 29(a)(4)(E), counsel for *amici curiae* hereby states that no counsel for any party to this litigation authored this brief in whole or in part; no party or party's counsel contributed money that was intended to fund, or did fund, the preparation or submission of this brief; and no person, other than *amici curiae*, contributed money that was intended to fund, or did fund, the preparation or submission of this brief. All parties have consented to the filing of this *amicus* brief.

illnesses, premature death, and escalating emergency room visits. This brief describes the public health necessity of regulating and reducing motor vehicle emissions, particularly greenhouse gas emissions, through the Environmental Protection Agency's (EPA) Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards ("the Standards"). *Amici*'s collective medical, scientific, and clinical expertise leads them to support the position of the respondents.

BACKGROUND[2]

The Clean Air Act aims "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare." 42 U.S.C. § 7401(b)(1). To this end, Section 7521(a) of the Act requires EPA to regulate motor vehicle emissions that "endanger public health or welfare." 42 U.S.C. § 7521(a). Under Section 7521(a), EPA recently established fleet-wide carbon dioxide emissions limitations for new passenger cars and light trucks (or "light-duty vehicles"). *Notice of Decision*, 86 Fed. Reg. 74,450 (U.S. Env't Prot. Agency, Dec. 30, 2021). These Standards set year-by-year progressing limitations on grams

[2] Counsel for *amici curiae* wish to note their thanks to law students Brett David Gerardi and Abigail Johnson for their assistance with this brief.

of carbon dioxide per mile, culminating in 161 grams per mile in 2026. *Id.* at 74,446.[3] Petitioners have challenged the Standards' lawfulness.

SUMMARY OF THE ARGUMENT

The Clean Air Act is a public health statute. Congress passed the Act in response to grave public health concerns that arose from the degradation of the nation's air quality, which was caused in part by increasing numbers of motor vehicles in the twentieth century. Section 7521(a) of the Act requires EPA to promulgate vehicle emissions regulations in order to protect public health.

EPA's Standards serve that precise aim. By regulating carbon dioxide emissions from vehicles, the Standards will provide vital public health benefits. First, the Standards are intended to slow climate change and the public health crises that it foments. Second, the Standards are intended to decrease the emissions of traditional air pollutants from vehicle tailpipes and upstream sources. This goal

---

[3] EPA and the National Highway Traffic Safety Administration had previously issued a joint rule establishing greenhouse gas emissions standards for new light-duty vehicles in 2012. *Notice of Decision*, 75 Fed. Reg. 25,324 (U.S. Env't Prot. Agency, May 7, 2010). In 2020, the agencies rescinded that rule and promulgated standards that drastically lowered the annual reduction in greenhouse gas pollution from vehicle emissions. *See Notice of Decision*, 85 Fed. Reg. 24,174 (U.S. Env't Prot. Agency, Apr. 30, 2020). After taking office, President Biden directed the EPA to review the greenhouse gas light-duty vehicle emissions standards—a process that resulted in the Standards at issue. Exec. Order No. 13990, 86 C.F.R. 7037 (Jan. 20, 2021).

is accomplished by diminishing the extraction, refinement, transport, and distribution of vehicle fuels. *See* 86 Fed. Reg. at 74,443-45, 74,490-92.

The carbon dioxide emissions that the Standards regulate contribute directly to climate change, which poses extraordinary risks to public health. Health harms caused by climate change include heat-related illnesses, wildfire-induced respiratory and cardiovascular illnesses, asthma attacks brought on by concentrations of pollen and ozone, flooding and water-borne diseases, and the spread of vector-borne diseases. By imposing emissions limits on carbon dioxide, the Standards are expected to reduce the transportation sector's contribution to climate change by 3.1 billion tons of carbon dioxide by 2050. *Id.* at 74,437.

The Standards' limits on carbon dioxide emissions have the additional benefits of reducing harms caused by traditional air pollution like particulate matter and ozone component emissions. These emissions are associated with severe cardiovascular and lung complications, including asthma, hospitalizations, and death. EPA estimates that the Standards will reduce particulate matter emissions by 1,161 tons by 2050. *Notice of Decision*, 86 Fed. Reg. 74,490-92.

Emissions of carbon dioxide and traditional air pollutants are particularly harmful to children, pregnant women, the elderly, communities of color, under-resourced communities, and people with pre-existing health conditions. The Standards will mitigate the disproportionate and severe harms these populations

face from climate change and air pollution. Volumes of peer-reviewed science on the health effects of climate change and air pollution reinforce the conclusion that protective action from the EPA is sorely needed. Without such protective measures, current and future generations will be subject to worsening and compounding dangers from climate change and air pollution. The Standards are critical to safeguarding public health in line with the language and legislative intent of the Clean Air Act.

ARGUMENT

I. EPA's Standards are consistent with the Clean Air Act's purpose of promoting public health.

The Clean Air Act's primary goal is promoting public health. 42 U.S.C. § 7401(b)(1). As motor vehicle pollution worsened the nation's air quality during the twentieth century, Congress passed the Act in an effort to protect against the increasingly severe illnesses caused by such pollution. *Id.* The Act's motor vehicle emission standards in Section 7521(a) *mandate* that EPA identify air pollutants that endanger public health or welfare. 42 U.S.C. § 7521. EPA must establish emissions standards that limit the quantity, rate, or concentration of the targeted pollutants and design a method by which this is to be accomplished. *Id*; 42 U.S.C. § 7602(k). As described below, the Standards under review safeguard public health by

mitigating the adverse health effects associated with air pollution and climate change.

Health was of paramount importance to Congress in expanding the Act's scope to regulate motor vehicle emissions. A cosponsor of the 1970 amendments, Senator Charles Vanik, stated that his support was driven by the bill's protective automobile requirements, which put human health "in the priority in which it belongs — first place."[4] The first version of what became Section 7521(a) required that the EPA consider technical and economic feasibility in vehicle emissions standards,[5] but the Senate amendments to the bill removed these factors.[6] Senator Edmund Muskie, an architect of the legislation, made clear that it was imperative to grant EPA the authority to promulgate standards that would lead to substantial reductions in vehicle emissions.[7] He noted that constraints on EPA's authority to

---

[4] *See* Statement of Senator Charles Vanik, Conference Report and Debates, 1 Legislative History of the Clean Air Amendments of 1970 Together with a Section-by-Section Index 111, 120 (1970).

[5] *See id.* at 198-99.

[6] *Id.*

[7] *Id.* at 126.

set emissions standards would "compromise the health of our people and lead to inadequate standards."[8]

According to Senator Muskie, the Senate made these changes to the original House version because they intended to require vehicle manufacturers to consider "alternatives to the internal combustion engine and new forms of transportation."[9] Both houses came to an agreement requiring standards to be "based on protection of public health and welfare without regard to the propulsion system."[10] By targeting the extraordinary public health harms of carbon dioxide emissions, the challenged Standards fall well within EPA's statutory authority, comport with the language and purpose of the Act, and are not arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.

II. The Standards reduce vehicle emissions that harm public health.

The Standards impose limits on the amounts of carbon dioxide vehicles may emit. 86 Fed. Reg. 74,445. When released into the atmosphere, carbon dioxide and other greenhouse gases trap a portion of the sun's heat that the Earth radiates back

---

[8] *Id.* at 125.

[9] *Id.* at 126-27.

[10] *Id.* at 131.

into space, causing global land and ocean temperatures to rise. *Id.* at 74,489.[11] Through this process, carbon dioxide from fossil fuel combustion has altered weather patterns and other natural cycles across the world. The transportation sector generates almost a third of the United States' greenhouse gas emissions, *id.* at 74,490, and carbon dioxide is the primary greenhouse gas emitted by vehicular fuels. *Id.* at 74,446.[12]

By lowering emissions from the largest greenhouse gas source in the country, the Standards will eliminate approximately 3.1 billion tons of expected greenhouse gas emissions by 2050. *Id*. at 74,446. Reductions in carbon dioxide emissions will contribute towards the goal of limiting the increase in global average temperature to below 2 degrees Celsius. *Id*. at 74,490. Lowering greenhouse gas emissions is important because climate change causes severe

---

[11] *See also* EPA, *Causes of Climate Change*, https://www.epa.gov/climatechange-science/causes-climate-change.

[12] By extension, lower carbon dioxide emissions result in smaller rises in surface temperatures. *See* David H. Levinson & Christopher J. Fettig, *Climate Change: Overview of Data Sources, Observed and Predicted Temperature Changes, and Impacts on Public and Environmental Health*, Global Climate Change and Pub. Health 31, 35 (Kent E. Pinkerton & William N. Rom eds., 2014).

public health harms. These include heat-related illnesses, wildfires, pollen, ozone, flooding, and vector-borne diseases.[13]

A. Carbon dioxide emissions worsen heat-related illnesses.

Ambient temperatures have risen in the last few decades and are predicted to increase over the next century.[14] The frequency of "heat waves," measured as the number of days during which maximum temperatures exceed 100 degrees Fahrenheit, is also predicted to increase.[15] The northern hemisphere is warming faster than the rest of the world, and temperatures in the United States are projected to increase by two degrees Celsius 10 to 20 years before the global mean.[16]

The consequences of elevated temperatures due to climate change are deadly. Heat is among the deadliest weather-related phenomena in the United

---

[13] *See, e.g.*, Kim Knowlton et al., *Six Climate Change Related Events in the United States Accounted for About $14 Billion In Lost Lives and Health Costs*, 30 Health Aff. 2167, 2168 (2011) (describing the health costs of climate change).

[14] Levinson & Fettig, *supra* note 12, at 35.

[15] *Id.*; Neal Fann et al., *The Geographic Distribution And Economic Value Of Climate Change-Related Ozone Health Impacts In The United States In 2030*, 65 J. Air & Waste Mgmt. Ass'n 570, 574 (2015).

[16] Ambarish V. Karmalkar & Raymond S. Bradley, *Consequences of Global Warming of 1.5°C and 2°c for Regional Temperature and Precipitation Changes in the Contiguous United States*, 12 PLoS ONE e0168697 1, 1 (2017).

States, killing more people annually than floods and storms combined.[17] Exposure to extreme temperatures even for brief periods can increase rates of heart attacks,[18] heat stroke and heat exhaustion.[19] Heat can be particularly harmful to those with pre-existing conditions.[20] As a result, emergency room visits for kidney failure, heat stroke, intestinal infection, diabetes, and asthma spike during heat waves.[21] Other climate change-driven adverse health outcomes of heat include decreased lung function and preterm births, which result in stillbirths and low birth weight.[22]

---

[17] Elisaveta Petkova et al., *Heat-Related Mortality in a Warming Climate: Projections for 12 U.S. Cities*, 11 Int'l J. Env't Rsch. Pub. Health 11371, 11371 (2014).

[18] Sebastian T. Rowland, et al., *Can Ultra Short-Term Changes In Ambient Temperature Trigger Myocardial Infarction?*, 143 Env't Int'l 105910, 105916 (2020).

[19] Tianqi Chen et al., *Time-series Analysis of Heat Waves and Emergency Department Visits in Atlanta, 1993 to 2012,* 125 Envtl. Health Persp. 057009 1, 1 (2017).

[20] Mare Lõhmus, *Possible Biological Mechanisms Linking Mental Health and Heat-A Contemplative Review*, 15 Int'l J. of Env't Rsch. Pub. Health 1, 2, 7 (2018) (discussing how individuals with pre-existing mental health disorders were more likely to die during the 1995 California heat wave).

[21] *Id.*; Tania Busch Isaksen et al., *Increased hospital admissions associated with extreme-heat exposure in King County, Washington, 1990-2010*, 30 Rev. Env't Health 51, 51-64 (2015).

[22] Allison Crimmins et al., *The Impacts of Climate Change on Human Health In The United States: A Scientific Assessment*, U.S. Glob. Change Rsch. Program 50 (2016), http://dx.doi.org/10.7930/J0R49NQX; Bruce Bekkar et al., *Association of Air Pollution and Heat Exposure with Preterm Birth, Low Birth Weight, and*

Extreme heat also affects mental health. Psychiatric hospital visits increase during hotter temperatures, and heat has been found to amplify the risk of suicide.[23] These problems compound because many medications used to treat mental health disorders inhibit the body's ability to regulate its heat, leading to hyperthermia—abnormally high body temperatures[24] that can cause organ dysfunction, affect the brain cooling process, and increase the brain's vulnerability to pathogens and toxins.[25] Heat waves also inhibit learning, contribute to increased levels of aggression, and impair cognition, mood, and sleep.[26]

Stillbirth in the US: A Systematic Review, 3 JAMA Network Open e208243, 1-13 (2020). Low birth weight is associated with severe health and developmental difficulties. Douglas Almond et al., *The Costs of Low Birth Weight*, 120 Q. J. Econ. 1031, 1031 (2005).

[23] *See* Nick Obradovich et al., *Empirical Evidence Of Mental Health Risks Posed By Climate Change*, 115 Proc. Nat'l Acad. Sci. 10953, 10953 (2018).

[24] Lõhmus, *supra* note 20, at 1515.

[25] *Id*.

[26] R. Jisung Park et al., *Learning Is Inhibited By Heat Exposure, Both Internationally And Within The United States*, 5 Nature Human Behavior 19, 20 (2020); Nick Obradovich et al., *Nighttime Temperature And Human Sleep Loss In A Changing Climate*, 3 Sci. Advances. e1601555, 1 (2017); Marshall Burke et al., *Climate and Conflict*, 7 Ann. Rev. Econ. 577, 577-617 (2015).

As a result of these harms, warmer temperatures associated with climate change are projected to result in more premature deaths in the United States.[27] Two summers ago, temperatures soared across the Pacific Northwest, reaching 116°F in Portland.[28] As these record-shattering temperatures seared Oregon and Washington, people flooded emergency rooms, which struggled to admit the surge of patients as medical equipment overheated.[29] This deadly heatwave would have been virtually impossible in the absence of human-caused climate change.[30] By reducing carbon dioxide emissions from vehicles, the Standards seek to mitigate the severity of deadly heat.

---

[27] *See* Jennifer F. Bobb, et al., *Heat-related Mortality and Adaptation to Heat in the United States*, 122 Envtl. Health Persp. 811, 811-14 (2014).

[28] Paul J. Schramm et al., *Heat-Related Emergency Department Visits During the Northwestern Heat Wave – United States, June 2021*, 70 Morbidity and Mortality Wkly. Rep. 1020, 1020 (2021) (noting that temperatures reached 42°F hotter than average June temperatures).

[29] Joanne Silberner, *Heat Wave Causes Hundreds Of Deaths And Hospitalizations In Pacific North West*, 374 BMJ 1696, 1696 (2021).

[30] Sjouke Y. Philip et al., *Western North American Extreme Heat Virtually Impossible Without Human-Caused Climate Change*, World Weather Attribution Initiative (July 7, 2021) https://www.worldweatherattribution.org/western-north-american-extreme-heat-virtually-impossible-without-human-caused-climate-change/.

B. Carbon dioxide emissions fuel more frequent and dangerous fires.

Wildfires are a striking visualization of climate change's dangers to public health. In 2020, the world watched the skies above San Francisco turn a murky orange from the smoke plumes of twenty-eight major fires burning simultaneously throughout California.[31] Wildfire exposure causes death, burns, post-traumatic stress disorder, and acute exacerbation of pre-existing respiratory conditions.[32] Climate change-linked increases in temperature and aridity have increased these fires' frequency and intensity.[33] Wildfires also generate ozone and particulate matter pollution,[34] which, in turn, exacerbate respiratory and cardiovascular

---

[31] *E.g.*, BBC News, *California wildfires: Smoke turns skies orange* (Sept. 10, 2020), https://www.bbc.com/news/world-us-canada-54096319.

[32] *See* Katelyn O'Dell et al., *Estimated Mortality and Morbidity Attributable to Smoke Plumes in the United States: Not Just a Western US Problem*, 5 GeoHealth (2021).

[33] James Vose et al., *Effects of Climatic Variability and Change on Forest Ecosystems: A Comprehensive Science Synthesis for the U.S. Forest Sector* 249-51 (2012), https://www.fs.usda.gov/pnw/pubs/pnw_gtr870/pnw_gtr870.pdf.

[34] Christopher G. Nolte et al., *Air Quality*, *in Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States*, U.S. Glob. Change Rsch. Program, 512, 521 (2018) ("Wildfire and prescribed fires … together compris[e] about 40% of directly emitted PM2.5 in the United States in 2011."); Daniel A. Jaffe & Nicole L. Wigder, *Ozone Production From Wildfires: A Critical Review*, 51 Atmospheric Env't 1, 2 (2012).

conditions and increase hospitalizations and deaths.[35] Wildfire smoke exposure can result in asthma, chronic obstructive pulmonary disease, acute bronchitis and bronchiolitis, upper respiratory infections, and pneumonia.[36]

Respiratory and cardiovascular-related hospitalizations rise during fire season; and wildfire fumes are especially damaging to people with asthma.[37] The risk of death increases for all individuals, however, regardless of whether they have a pre-existing condition.[38] Although wildfire conditions are felt most acutely in the Western United States, the effects are national and global. Particulate matter and ground-level ozone, which cause significant health harms as described below

---

[35] *See* David Mills et al., *Projecting Age-Stratified Risk of Exposure to Inland Flooding and Wildfire Smoke in the United States under Two Climate Scenarios*, 126 Env't Health Persp. 047007 at 1 (2018). For a discussion of the public health impacts of particulate matter and ozone, *see infra* IC and IF.

[36] *See, e.g.*, Ana G. Rappold et al., *Cardio-Respiratory Outcomes Associated With Exposure To Wildfire Smoke Are Modified By Measures Of Community Health*, 11 Envtl. Health 71 (2012).

[37] Jennifer D. Stowell et al., *Associations of Wildfire Smoke Exposure With Cardiorespiratory Events In Colorado 2011-2014*, 133 Env. Int'l 105151 (2019) (demonstrating that increased exposure to wildfire-derived PM2.5 was associated with increased respiratory hospitalizations, when separating out background particulate matter); Jaffe & Wigder, *supra* note 34 at 2, 7.

[38] Rappold et al., *supra* note 36, at 1; Johanna Lepeule et al., *Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009*, 120 Env't Health Persp. 965, 968 (2012).

in Part II.E, spread nationwide from wildfires' smoke plumes.[39] By lowering the carbon emissions that contribute to wildfires, the Standards better protect the public from the numerous health risks associated with increased fire frequency and intensity.

C. Carbon dioxide emissions lead to more floods.

Climate change-linked higher temperatures exacerbate flooding, because warmer air provides more moisture to rainfall events, which leads to increased rainfall over short periods, producing dangerous floods.[40] "Heat stress events," in which high temperatures and humidity enhance stormy weather, compound this phenomenon, resulting in extreme precipitation.[41] Extreme floods in some regions of the United States have already increased by more than twenty percent in recent decades.[42] The magnitude and frequency of flooding are expected to grow with a warming climate due to increased precipitation and rising sea-levels.[43]

---

[39] *See, e.g.*, O'Dell et al., *supra* note 32.

[40] Seth Westra et al., *Future Changes To The Intensity And Frequency Of Short-Duration Extreme Rainfall*, 52 Rev. Geophysics 522, 522-25 (2014).

[41] Wei Zhang & Gabriele Villarini, *Deadly Compound Heat Stress Flooding Hazard Across the Central United States*, 47 Geophysical Res. Letters 1, 1 (2020).

[42] Wouter R. Berghuijs et al., *Recent Changes In Extreme Floods Across Multiple Continents*, 12 Env't Rsch. Letters 114035, 1140358 (2017).

[43] *Id.* at 114035.

The effects of floods include immediate fatalities and destroyed communities and infrastructure, such as damage to roads, hospitals, and power grids, as well as longer term effects like illnesses, infections, and diminished water quality.[44] When Hurricane Harvey struck Houston several years ago, it flooded more than 150,000 homes and impacted millions of people in Harris County alone.[45] Scientists opined that up to half of the affected properties in the County would not have flooded but for human-caused climate change.[46] Another 2011 study found that floods in North Dakota caused by severe storms and near-record snow melt resulted in approximately $145,495 in health costs per 1,000 people in the affected area.[47]

---

[44] Matthew Heberger et al., *Potential Impacts Of Increased Coastal Flooding In California Due To Sea-Level Rise*, 109 Climatic Change S229, S230 (2011).

[45] *E.g.*, Jeff Lindner & Steve Fitzgerald, *Immediate Report – Final: Hurricane Harvey – Storm and Flood Information*, Harris County Flood Control District, June 4, 2018, https://www.hcfcd.org/Portals/62/Harvey/immediate-flood-report-final-hurricane-harvey-2017.pdf.

[46] Kevin T. Smiley et al., *Social Inequalities In Climate Change-Attributed Impacts Of Hurricane Harvey*, 13 Nature Communications 3418, 1 (2022).

[47] Knowlton et al., *supra* note 13, at 2170.

Even after floodwaters recede, public health threats persist. Mold grows, placing residents at risk of contracting respiratory illnesses and fungal infections.[48] These diseases are associated with increases in asthma symptoms, rhinitis, rashes, and headaches.[49] Extreme flooding also diminishes water quality. Increased precipitation can exceed the capacity of sewer systems, causing them to discharge waste into surface waters, exposing people to untreated sewage.[50] These exposures cause gastrointestinal illness and other waterborne diseases, as well as contaminate drinking water with strains of fatal bacteria.[51] By lowering the carbon dioxide emissions that contribute to floods, the Standards will help curtail harmful flooding.

D. Carbon dioxide emissions increase vector-borne diseases.

Vector-borne diseases are transmitted by mosquitoes and ticks through infections. The range of mosquitoes, ticks, and the pathogens they carry are

---

[48] *See* Margaret A. Riggs et al., *Resident Cleanup Activities, Characteristics Of Flood-Damaged Homes And Airborne Microbial Concentrations In New Orleans, Louisiana, October 2005*, 106 Envtl. Res. 401, 405-7 (2005).

[49] *Id.* at 402.

[50] *See* EPA, *Report to Congress: Combined Sewer Overflows into the Great Lakes Basin* (2016), https://www.epa.gov/sites/default/files/2016-05/documents/gls_cso_report_to_congress_ -_ 4-12-2016.pdf.

[51] *See, e.g.*, Jonathan A. Patz et al., *Climate Change and Waterborne Disease Risk in the Great Lakes Region of the U.S.*, 35 Am. J. Preventive Med. 451, 455 (2008).

expanding due to the warmer temperatures induced by climate change.[52] This expanded range has led to the proliferation of mosquito-borne illnesses previously unknown in the United States, such as Zika and Dengue.[53] Zika causes fetal neurological complications and birth defects; Dengue fever can result in hemorrhage, shock, and death.[54] No specific therapeutic treatment is available for either disease.[55] Once limited to tropical and subtropical regions of the globe, Dengue outbreaks now occur in Hawaii, Florida, and Texas.[56] The United States also experienced its first local transmissions of Zika in 2016,[57] following extreme rainfall events and a series of the warmest years on record.[58] Likewise, the West Nile Virus, which is the most prevalent mosquito-borne disease in the United

---

[52] *See* Ilia Rochlin et al., *Climate Change and Range Expansion of the Asian Tiger Mosquito (Aedes Albopictus) in Northeastern USA: Implications for Public Health Practitioners*, 8 PLoS ONE e60874 at 1 (2013).

[53] Michael A. Robert et al., *Climate change and viral emergence: Evidence from Aedes-borne arboviruses*, 40 Current Opinion Virology 41 (2020).

[54] *Id.* at 41.

[55] *Id*. at 42.

[56] *Id*.

[57] Nathan D. Grubaugh et al., *Genomic Epidemiology Reveals Multiple Introductions Of Zika Virus Into The United States*, 546 Nature 401, 401-02 (2017).

[58] Robert et al., *supra* note 53.

States,[59] was introduced to the country in 1999 following a prolonged spring drought and a three-week July heat wave.[60] West Nile Virus is a neuroinvasive disease that can attack the central nervous system, resulting in hospitalization and death.[61]

In addition to mosquitoes, the ranges of several tick species are expanding throughout the United States in response to increased temperatures.[62] Ticks are responsible for almost 95 percent of all vector-borne diseases reported annually in the United States, including Lyme disease, Rocky Mountain spotted fever, human granulocytic and monocytic anaplasmosis, and tick-borne encephalitis.[63] Tick bites can cause blood loss, toxic reactions, and death.[64] Higher average temperatures will allow vectors' range to expand; the Standards' requirements for lower carbon

---

[59] Carolyn A. Reimann et al., *Epidemiology of Neuroinvasive Arboviral Disease in the United States, 1999- 2007*, 79 Am. J. Tropical Med. Hygiene 974, 974 (2008).

[60] Paul Epstein, *The Ecology Of Climate Change And Infectious Diseases: Comment*, 91 Ecology 925, 927 (2010).

[61] Reimann et al., *supra* note 59, at 974.

[62] Daniel E. Sonenshine, *Range Expansion of Tick Disease Vectors in North America: Implications for Spread of Tick-Borne Disease*, 15 Int'l J. Env't Rsch. Pub. Health 478, 479 (2018).

[63] *Id.*

[64] *Id.* at 478.

dioxide emissions from vehicles will lessen such emissions' contribution to rising temperatures and their resultant harms.

E. Carbon dioxide use in vehicles impairs air quality by increasing harmful pollen, ground level ozone, and particulate matter pollution.

1. Pollen. Carbon dioxide induces warmer temperatures and, as a result, plants bloom earlier and release more spores over a longer period of time, lengthening pollen seasons and making their effects more severe.[65] Carbon dioxide also stimulates the growth and flower production of many allergenic plants.[66] The increased incidence of precipitation events associated with climate change further exacerbates the adverse health effects of pollen because pollen spores rupture when exposed to moisture, enabling allergens to enter smaller airways in the lungs.[67] Climate change's meteorological effects include more frequent and severe

---

[65] *See* Lewis Ziska & Gary D. Berman, *Impact of Climate Change on Aeroallergenic Pollen Metrics: A Hemispheric Perspective*, 33 Current Allergy & Clinical Immunology 93, 94 (2020); Lewis Ziska et al., *Recent warming by latitude associated with increased length of ragweed pollen season in central North America*, 108 Proc. Nat'l Acad. Sci. 4248, 4248 (2011); William R.L. Anderegg et al., *Anthropogenic climate change is worsening North American pollen seasons*, 118 Proc. Nat'l Acad. Sci. e2013284118 at 1 (2021).

[66] Ziska & Berman, *supra* note 65, at 94.

[67] Shuaib M. Nasser & Thomas B. Pulimood, *Allergens and Thunderstorm Asthma*, 9 Current Allergy & Asthma Rep. 384, 387-88 (2009).

thunderstorms, which exacerbate this phenomenon by causing sudden pollen releases.[68]

Increased pollen concentrations and longer pollen seasons cause higher sensitivity to allergens and increased duration and severity of allergic symptoms.[69] This results in more asthma attacks and emergency room visits for adults and children.[70] Longer and more intense allergy seasons pose a severe threat to the 25.2 million Americans who already suffer from asthma,[71] because exposure to the allergens within pollen is a risk factor for developing allergic asthma.[72] After developing allergic asthma, further exposure to pollen can trigger asthma attacks

---

[68] Andrew Rorie & Jill A. Poole, *The Role of Extreme Weather and Climate-Related Events on Asthma Outcomes*, 41 Immunology & Allergy Clinics N. Am. 73 (2021).

[69] *See* Ziska et al., *supra* note 65.

[70] James E. Neumann et al., *Estimates of Present and Future Asthma Emergency Department Visits Associated with Exposure to Oak, Birch, and Grass Pollen in the United States*, 3 GeoHealth 11, 24 (2019).

[71] Centers for Disease Control & Prevention, *Most Recent National Asthma Data*, https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm.

[72] *See* Susan C. Anenberg et al., *Impacts Of Oak Pollen On Allergic Asthma In The United States And Potential Influence Of Future Climate Change*, 1 GeoHealth 80, 80-81 (2009).

and exacerbate symptoms,[73] which can cause permanent airway damage.[74] Reducing carbon dioxide emissions is likely to mitigate these harms.

2. Ozone. Ozone is formed when nitrogen oxide and volatile organic compound emissions react to sunlight and heat.[75] The warmer temperatures caused by climate change increase ozone formation and worsen the pollutant's negative health impacts.[76] Ozone irritates lungs and airways, exacerbates chronic obstructive pulmonary disease, emphysema, and chronic bronchitis, and can cause premature death.[77] Ozone exposure is correlated to the development of asthma and asthma attacks.[78] Epidemiological studies show significant correlations between long-term ozone exposure and reduced airway function, while decreases in ozone

---

[73] *See id.*; Clarisse Gautier & Denis Charpin, *Environmental Triggers And Avoidance In The Management Of Asthma*, 10 J. Asthma & Allergy 47 (2017).

[74] Gary S. Rachelefsky, *From the Page to the Clinic: Implementing New National Asthma Education and Prevention Program Guidelines*, 9 Clinical Cornerstone 9, 9-10 (2009).

[75] EPA, *Ground-level Ozone Basics*, https://www.epa.gov/ground-level-ozonepollution/ground-level-ozone-basics#formation.

[76] *See id*.

[77] Centers for Disease Control & Prevention, *Ozone and Your Health*, https://www.cdc.gov/air/ozone.html.

[78] *See* Nicholas Nassikas et al., *Ozone-Related Asthma Emergency Department Visits in The US in A Warming Climate*, 183 Env't Rsch. 109206 (2020).

exposure are associated with lower incidences of asthma in children.[79] Ozone exposure also leads to cardiovascular disease and cardiac arrest.[80] Even brief periods of exposure to ozone are associated with an increased risk of death from cardiovascular and respiratory complications.[81] The Standards will limit ozone formation by reducing some of the warmer temperatures caused by climate change, while also limiting emissions of ozone precursors from tailpipes and upstream sources.

3. Particulate matter. Particulate matter is associated with respiratory and cardiovascular illnesses, heart attacks, aggravated asthma, and decreased lung function. *See Notice of Decision*, 86 Fed. Reg. 74,443. EPA estimates that by reducing particulate matter along with ozone, the Standards will lead to between $8 billion and $19 billion in public health benefits by 2050. *Id.* Particulate matter is a mixture of solid particles and liquid droplets in the air, ranging in size from visible particles to particles so small they can only be detected with an electron

---

[79] *See* Erika Garcia et al., *Association of Changes in Air Quality with Incident Asthma in Children in California*, 1993–2014, 321(19) JAMA 1906 (2019).

[80] *See* Klea Katsouyanni et al., *Air Pollution and Health: A European and North American Approach (APHENA)*, 142 Res. Rep. Health. Effects Inst. 5, 5–6, 15 (2009).

[81] *See* Alexandros Gryparis et al., *Acute Effects of Ozone on Mortality from the "Air Pollution and Health: A European Approach" Project*, 170 Am J. Respir. Crit. Care Med. 1080, 1080-87 (2004).

microscope.[82] Particulate matter comes from tailpipe and upstream fossil fuel emissions; by encouraging alternatives to fossil fuels and fossil fuel efficiency, the Standards will reduce both types of emissions.

Exposure to particulate matter impacts the respiratory, nervous, and cardiovascular systems and increases the risk of heart and lung illness, cancers, and premature death.[83] Particles less than 2.5 micrometers in diameter pose the greatest health risk, as they can travel deep into the lungs and bloodstream.[84] Long-term particulate matter exposure impacts cardiovascular risk, lung injuries, and subclinical atherosclerosis—the accruing of fats and other substances in the arteries.[85] Particulate matter can also cause lung cancer.[86] In every case, the

---

[82] EPA, *Particulate Matter (PM) Basics,* https://www.epa.gov/pm-pollution/particulate-matter-pm-basics.

[83] Stephen S. Lim et al., *A Comparative Risk Assessment of Burden of Disease and Injury Attributable to 67 Risk Factors and Risk Factor Clusters in 21 Regions, 1990-2010: A Systematic Analysis for the Global Burden of Disease Study 2010*, 380 Lancet 2224, 2227 (2012); EPA, *Integrated Science Assessment for Particulate Matter,* 1-21–1-31 (Dec. 2019), https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534#tab-3.

[84] *Id*.

[85] C. Arden Pope III & Douglas W. Dockery, *Health Effects of Fine Particulate Air Pollution: Lines That Connect*, 56 J. Air & Waste Mgmt. Ass'n 709, 731–32 (2006).

[86] *See, e.g.*, K.R. Cromar et al., *Excess Morbidity and Mortality Associated with Air Pollution above American Thoracic Society Recommended Standards, 2017-2019*, 19 Ann. Am. Thorac. Soc. 603, 605 (2022). Exposure to air pollution in

association between particulate matter exposure and negative health impacts is stronger when exposure is concentrated, such as a neighborhood in close proximity to a highway or other high-traffic area.[87]

Even short-term particulate matter exposure may lead to cardiovascular and stroke mortality, hospital admissions, post-neonatal infant mortality, and altered cardiac autonomic function.[88] By reducing particulate matter emissions from tailpipes and upstream sources, as well as climate change-fueled events like large fires, the Standards will reduce particulate matter's negative public health effects.

III. The Standards will benefit communities that face disproportionate harm from climate change and air pollution.

Adverse health effects due to climate change and air pollution fall disproportionately on pregnant women, young children, adults above the age of sixty-five, communities of color, communities earning lower incomes, and people

---

California has also been connected to the severity of COVID-19 cases and is associated with a spike in COVID-19-related mortality. Zhanghua Chen et al., *Near-Roadway Air Pollution Associated With COVID-19 Severity And Mortality - Multiethnic Cohort Study In Southern California*, 157 Env't Int. 1, 1–8 (2021); *see also* Zhanghua Chen et al., *Ambient Air Pollutant Exposures and COVID-19 Severity and Mortality in a Cohort of Patients with COVID-19 in Southern California*, 2006 Am. J. Respiration Critical Care Med. 440, 440–48 (2022).

[87] Garcia et al., *supra* note 79.

[88] *See* Bart Ostro et al., *Associations of Source-Specific Fine Particulate Matter With Emergency Department Visits in California*, 184 Am. J. Epidemiology 450, 452 (2015); Arden Pope III & Dockery, *supra* note 85 at 710 .

with pre-existing medical conditions.[89] These populations are more susceptible to the health risks of climate change and air pollution due to social and physical factors including increased exposure risk, a lack of access to healthcare, and differing levels of adaptive capacity.[90]

Young children, especially infants, are more susceptible to climate change-induced hotter temperatures because their bodies do not regulate their internal temperature as well as adults.[91] Their vulnerability leads to increased emergency hospitalizations due to heat for children under four years old.[92] Children are also more susceptible to air pollution because they spend more time outdoors, have higher respiratory rates, and are still developing their organs and immune

---

[89] *See, e.g.*, Jill A. Poole et al., *Impact of Weather and Climate Change with Indoor and Outdoor Air Quality in Asthma: A Work Group Report of the AAAAI Environmental Exposure and Respiratory Health Committee*, 143(5) J. Allergy & Clinical Immunology 1702, 1704 (2019).

[90] *See, e.g.*, Kimberly Thomas et al., *Explaining Differential Vulnerability to Climate Change: A Social Science Review*, 10(2) Climate Change 565 (2019).

[91] *See* Kim Knowlton et al., *The 2006 California Heat Wave: Impacts on Hospitalizations and Emergency Department Visits*, 117 Env't Health Persp. 61, 61 (2009); Aaron S. Bernstein & Samuel S. Myers, *Climate Change And Children's Health*, 23 Current Opinion in Pediatrics 221, 222 (2011).

[92] *See* Knowlton et al., *supra* note 91 at 61.

systems.[93] These vulnerabilities exacerbate respiratory diseases and reduce lung function development, while also increasing asthma incidence, pediatric cancers, and neurodevelopmental disorders.[94]

Climate change also imposes severe adverse health risks on people aged sixty-five and older. Older people are more likely to be hospitalized or die from high temperatures due to an increased likelihood of pre-existing health vulnerabilities.[95] The elderly are at greater risk of cardiovascular and respiratory illnesses due to air pollution.[96] A study of Medicare beneficiaries showed that long-term exposures to particulate matter and ozone were associated with an increased risk of death.[97]

Race and income are also predictors of climate and pollution-related health risks. Communities of color and communities with lower incomes are more likely

---

[93] Heather L. Bromberg et al., *Ambient Air Pollution: Health Hazards to Children*, 147 Pediatrics e2021051484 at 1 (2021).

[94] *Id.*

[95] *See* Ambarish Vaidyanathan et al., *Heat-Related Deaths - United States, 2004-2018*, 69 Morbidity & Mortality Wkly. Rep. 729 (2020).

[96] *See* G. Brooke Anderson et al. *Heat-related Emergency Hospitalizations for Respiratory Diseases in the Medicare Population*, 187 Am. J. Respiratory & Critical Care Med. 1098 (2013).

[97] Qian Di et al., *Air Pollution and Mortality in the Medicare Population*, 376 N. Engl. J. Med. 2513, 2517 (2018).

than average to be situated near a high-volume road or in an area with greater traffic density.[98] Partly as a result of proximity to sources of pollution, these communities experience higher exposure risk to particulate matter pollution.[99] Additionally, African American men and persons eligible to receive Medicaid have a higher risk of death associated with exposure to air pollution.[100]

Pregnant women, young children, adults over sixty-five, communities of color, under-resourced communities, and people with pre-existing medical conditions face increased health risks due to climate change and air pollution. These populations' health will benefit from the emissions reductions that the Standards mandate.

* * *

If emissions of greenhouse gases such as carbon dioxide are left unchecked, global warming will continue, causing worsening and compounding public health consequences. The Standards reduce carbon dioxide emissions that gravely harm

---

[98] *See* Gregory M. Rowangould, *A Census of the US Near-Roadway Population: Public Health and Environmental Justice Considerations*, 25 Transp. Res. Part D 59, 59, 66 (2013).

[99] 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).

[100] Di et al., *supra* note 97, at 2517.

public health. They are faithful to the language and intent of the Clean Air Act, and they are not arbitrary or capricious. This Court should uphold them.

CONCLUSION

The petitions for review should be denied.

Dated: March 3, 2023

Respectfully Submitted,

/s/ Sara A. Colangelo
Sara A. Colangelo
Jack H.L. Whiteley
Lindsay A. Bailey
Environmental Law & Justice Clinic
Georgetown University Law Center
600 New Jersey Avenue, NW
Washington, D.C. 20001-2075
Counsel for Amici Curiae

CERTIFICATE OF COMPLIANCE

I certify that pursuant to Federal Rule of Appellate Procedure 32(a)(7), the attached Brief of *amici curiae* the American Thoracic Society, American Medical Association, American Public Health Association, American College of Occupational and Environmental Medicine, American Academy of Pediatrics, American Association for Respiratory Care, Climate Psychiatry Alliance, American College of Physicians, American College of Chest Physicians, Academic Pediatric Association, and American Academy of Allergy, Asthma and Immunology contains 6,012 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(f).

I further certify that this brief complies with the typeface requirements of Fed. R. App. P. 32(a)(5) and the type-style requirements of Fed. R. App. P. 32(a)(6) because it was prepared using Microsoft Office Word 2020 and uses a proportionally spaced typeface, Times New Roman, in 14-point type.

I further certify that all privacy redactions have been made.

I further certify that all paper copies submitted to this Court are exact copies of this version, which is being submitted electronically via the Court's CM/ECF system. I further certify that the electronic submission was scanned for viruses with the most recent version of a commercial virus scanning program and is free of viruses.

/s/ Sara A. Colangelo Date: March 3, 2023
SARA A. COLANGELO
Counsel of Record

CERTIFICATE OF SERVICE

I hereby certify that on March 3, 2023, I electronically filed the foregoing Brief of *amici curiae* the American Thoracic Society, American Medical Association, American Public Health Association, American College of Occupational and Environmental Medicine, American Academy of Pediatrics, American Association for Respiratory Care, Climate Psychiatry Alliance, American College of Physicians, American College of Chest Physicians, Academic Pediatric Association, and American Academy of Allergy, Asthma and Immunology with the Clerk of the Court for the United States Court of Appeals for the District of Columbia Circuit by using the Court's CM/ECF system. I further certify that all parties are represented by counsel registered with the CM/ECF system, so that service will be accomplished by the CM/ECF system.

/s/ Sara A. Colangelo Date: March 3, 2023
SARA A. COLANGELO
Counsel of Record