ORAL ARGUMENT SCHEDULED FOR JUNE 2, 2016

No. 15-1363 and consolidated cases

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

State of West Virginia, *et al.*,
Petitioners,

v.

United States Environmental Protection Agency, and Regina A. McCarthy, Administrator,
Respondents.

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

BRIEF OF THE AMERICAN THORACIC SOCIETY, AMERICAN MEDICAL ASSOCIATION, AMERICAN ACADEMY OF PEDIATRICS, NATIONAL MEDICAL ASSOCIATION, AMERICAN COLLEGE OF PREVENTIVE MEDICINE, AMERICAN COLLEGE OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE, NATIONAL ASSOCIATION FOR MEDICAL DIRECTION OF RESPIRATORY CARE, AND AMERICAN PUBLIC HEALTH ASSOCIATION AS *AMICI CURIAE* IN SUPPORT OF RESPONDENTS

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CORPORATE AND FINANCIAL DISCLOSURE STATEMENT PURSUANT TO FEDERAL RULES OF APPELLATE PROCEDURE 26.1, 29(c) AND D.C. CIRCUIT LOCAL RULE 26.1

Amici curiae are all nonprofit organizations. No party to this filing has a parent corporation, and no publicly held corporation owns 10% or more of the stock of any of the parties to this filing.

STATEMENT OF COUNSEL PURSUANT TO FEDERAL RULE OF APPELLATE PROCEDURE 29(c)(5)

Pursuant to Federal Rule of Appellate Procedure 29(c)(5), 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 the *amici curiae*, contributed money that was intended to fund, or did fund, the preparation or submission of this brief.

CERTIFICATE OF COUNSEL AS TO PARTIES, RULING UNDER REVIEW, AND RELATED CASES

Pursuant to D.C. Circuit Rule 28(a)(1)(A), counsel certifies as follows: to the best of my knowledge, all parties and *amici*, rulings under review, and related cases are set forth in the Brief for Respondents Environmental Protection Agency [1605911] and the Brief of *Amici Curiae* Former State Environmental and Energy Officials in Support of Respondents [1606565].

The American Academy of Pediatrics, the National Medical Association, the National Association for Medical Direction of Respiratory Care, and the American Public Health Association have contacted all parties regarding their intent to participate in this case as *amici*, and filed a motion with the Court for leave to participate in this litigation on April 1, 2016.

Respectfully submitted,

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GLOSSARY

CAA	Clean Air Act
EPA	United States Environmental Protection Agency

STATEMENT OF IDENTITY AND INTEREST OF AMICUS CURIAE[1]

Amici represent a broad spectrum of the United States medical and public health community. The collective medical expertise and concern for public health of the *amici* lead them to support the position of the Respondent Environmental Protection Agency (EPA). Carbon emissions are a significant driver of the anthropogenic greenhouse gas emissions that cause climate change and consequently harm human health, particularly for vulnerable populations. EPA's Clean Power Plan responds to the threat posed by climate change by motivating reductions in carbon emissions by 32 percent over 2005 levels by 2030. *Amici* participate in this action to describe the public health rationale for the Clean Power Plan, and the severity of the health impacts from climate change that may be expected if the Clean Power Plan is not upheld.

SUMMARY OF ARGUMENT

Anthropogenic emissions of greenhouse gases, such as carbon dioxide, are fueling changes in weather patterns and other natural cycles. The results of greenhouse gas- related changes in weather patterns include more frequent heat

[1] This Court granted leave for *amici* American Thoracic Society, American Medical Association, American College of Preventive Medicine, and American College of Occupational and Environmental medicine to participate in this action on January 27, 2016. Doc. No. 1595431. Proposed *amici* American Academy of Pediatrics, National Medical Association, National Association for Medical Direction of Respiratory Care, and the American Public Health Association filed a motion for leave to participate on April 1, 2016. As described in greater detail in that motion for leave to participate, no party opposes their participation as *amici*.

waves, increased temperatures, earlier, longer, and more intense allergy seasons, more frequent and intense storms, and increased incidence of forest fires. These impacts of climate change have a number of dangerous ramifications for human health.

Direct impacts from the changing climate include heat-related illness, declines in air quality, and increased respiratory and cardiovascular illness. The extreme weather expected to occur alongside climate change may lead to injury, disability, and death. Changes in climate also facilitate the migration of mosquito-borne diseases, such as dengue fever and malaria, into new locations, increasing exposure to these and other pathogens. These harmful effects are particularly potent for vulnerable populations such as children, the elderly, communities of color, and the poor.

Physicians in the United States are already observing the adverse human health effects of climate change. In surveys conducted by three separate U.S. medical professional societies, a significant majority of surveyed physicians concurred that climate change is occurring, that climate change is having a direct impact on the health of their patients, and that physicians anticipate even greater climate-driven adverse human health impacts in the future.[2]

[2] Mona Sarfaty et al., *A survey of African American physicians on the health effects of climate change*, 11 INT'L J. ENVTL. RESEARCH & PUBLIC HEALTH 12, 12473-85 (Dec. 2014); Mona Sarfaty, et al., *American Thoracic Society Member Survey on*

The Clean Power Plan responds to the mounting evidence of these health impacts. Section 111(d) of the Clean Air Act (CAA), 42 U.S.C. sec. 7411, empowers EPA to establish standards for the regulation of pollution from existing stationary sources of air emissions. In response to this directive, EPA has adopted regulations, codified at 40 CFR Part 60, which establish carbon pollution standards for power plants that will help to curtail the harmful health impacts of carbon pollution. Contrary to the claims of petitioners in these consolidated lawsuits, these regulations are well within EPA's statutory authority.

Failure to uphold the Clean Power Plan would undermine EPA's ability to carry out its legal obligation to regulate carbon emissions that endanger human health, and would negatively impact the health of current and future generations of Americans. *Amici* urge the Court to uphold the Plan because it is a legal means by which EPA has exercised its authority to curb carbon emissions, mitigate climate change, and potentially avoid the serious health consequences described in this brief.

Climate Change and Health, 12 ANNALS OF THE AM. THORACIC SOC'Y 2, 274-8 (Feb. 2015); Mona Sarfaty, et al., *Views of AAAAI members on climate change and health*, 4 J. ALLERGY & CLINICAL IMMUNOLOGY: IN PRACTICE 2, 333-335 (March/April 2016).

ARGUMENT

I. Climate Change, Caused by Utility Sector Carbon Emissions, Has Adverse Human Health Impacts.

Utilities are the largest industrial emitter in the United States of the emissions that cause climate change.[3] Left unchecked, continued use of fossil fuels responsible for climate change will increasingly create diverse risks for human health.[4] Heat waves will occur more often and will be more intense.[5] Forest fires will become more frequent and widespread, leading to rising rates of ground-level ozone and particulate matter formation.[6] Allergen concentrations will increase and

[3] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,662, 64,689 (Oct. 23, 2015)

[4] Bertil Forsberg et al., *An expert assessment on climate change and health–with a European focus on lungs and allergies*, 11 ENVTL. HEALTH (Supp. 1), June 28, 2012.

[5] THOMAS R. KARL ET AL., GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 24 (Thomas R. Karl et al. eds., 2009); *see also* P.B. Duffy & C. Tebaldi, *Increasing prevalence of extreme summer temperatures in the U.S.*, 111 CLIMATIC CHANGE 487 (2012).

[6] Sarah B. Henderson, *et al.*, *Three measures of forest fire smoke exposure and their associations with respiratory and cardiovascular health outcomes in a population-based cohort*, 119 Envtl. Health Perspectives 9, 1266 (2011); Daniel J. Jacob & Darrel A. Winner, *Effect of climate change on air quality*, 43 ATMOSPHERIC ENV'T 51, 59 (2009); Kazuyo Murazaki & Peter Hess, *How does climate change contribute to surface ozone change over the United States?*, 111 J. GEOPHYSICAL RES.: ATMOSPHERES, 1, 11, 15 (Mar. 16, 2006); Ralph J. Delfino, *et al.*, *The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003*, 66 OCCUPATIONAL AND ENVIRONMENTAL MEDICINE 3, 189-197 (2009).

persist longer,[7] regions affected by vector-borne illnesses will expand,[8] and extreme weather events will become more frequent and more extreme.[9] Through these and other causal channels, climate change will continue to increase injury and mortality for Americans, particularly for vulnerable populations.

A. Heat

"Climate change" is the term given to the effects caused by increasing concentrations of greenhouse gases that trap a higher portion of the sun's solar energy, leading to an overall rise in global land and ocean temperatures.[10] In consequence, climate change is expected to result in more heat waves,[11] and higher

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[7] *See generally* Lewis H. Ziska & Paul J. Beggs, *Anthropogenic climate change and allergen exposure: the role of plant biology*, 129 J. ALLERGY & CLINICAL IMMUNOLOGY 27 (2012); Lewis H. 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, 4249-50 (2011); Jean Emberlin, *Responses in the start of Betula (birch) pollen seasons to recent changes in spring temperatures across Europe*, 46 INT'L J. BIOMETEOROLOGY 159 (2002).

[8] Samantha Ahdoot & Susan E. Pacheco, *Global Climate Change and Human Health*, 136 PEDIATRICS 5, e1474 (Nov. 2015).

[9] Seth Westra, *et al.*, *Future changes to the intensity and frequency of short-duration extreme rainfall*, 52 REVIEWS OF GEOPHYSICS 3, 522-555 (2014).

[10] *See, e.g.*, Environmental Protection Agency, "Causes of Climate Change," https://www3.epa.gov/climatechange/science/causes.html (last visited March 22, 2016).

[11] Tiffany T. Smith *et al.*, *Heat waves in the United States: definitions, patterns, and trends*, 118 CLIMATE CHANGE 811, 812–13 (2013) (noting that "heat wave" does not have a universally accepted definition, but is generally used to refer to temperatures—or a temperature-plus-humidity metric—that exceed seasonally- and regionally-specific averages for two or more consecutive days).

ambient temperatures.[12] There is a well-documented connection between rising temperatures and death, especially among the elderly and people with chronic disease.[13] As one dramatic example, the 2003 European heat wave is estimated to have led to approximately 50,000 deaths in August alone.[14] During that heat wave, France experienced a single day heat-related death total of 2,000 and a monthly total of nearly 15,000.[15] Similar impacts have been seen in the United States. In

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[12] David H. Levinson & Christopher J. Fettig, *Climate Change: Overview of Data Sources, Observed and Predicted Temperature Changes, and Impacts on Public and Environmental Health*, *in* GLOBAL CLIMATE CHANGE AND PUBLIC HEALTH 31, 33–36 (Kent E. Pinkerton & William N. Rom eds., 2014) (collecting citations to leading research and summarizing past and projected increases in ambient temperatures); Scott Greene et al., *An examination of climate change on extreme heat events and climate-change mortality relationships in large U.S. cities*, 3 WEATHER, CLIMATE, & SOC'Y 281 (2011); Alexander Gershunov et al., *The Great 2006 Heat Wave over California and Nevada: Signal of an Increasing Trend*, 22 J. CLIMATE 6181 (2009).

[13] Shakoor Hajat & Tom Kosatky, *Heat-related mortality: a review and exploration of heterogeneity*, 64 J. EPIDEMIOLOGY & CMTY. HEALTH 753 (2010) (estimating from data that risk of mortality in various cities increased by 1-3% with each degree-Centigrade increase in temperature above threshold); Sumi Hoshiko, *et al.*, *A simple method for estimating excess mortality due to heat waves, as applied to the 2006 California heat wave*, 55 INT'L J. PUB. HEALTH 133 (2010); Mercedes Medina-Ramón & Joel Schwartz, *Temperature, temperature extremes, and mortality: a study of acclimatization and effect modification in 50 United States cities*, 64 J. OCCUPATIONAL & ENVTL. MED. 827 (2007) (identifying causal relationship based on over six million observations).

[14] Jean-Marie Robine *et al.*, *Death toll exceeded 70,000 in Europe during the summer of 2003*, 331 C.R. BIOLOGIES 171, 177 (2008).

[15] Laurent Argaud et al., *Short- and Long-term Outcomes of Heatstroke Following the 2003 Heat Wave in Lyon, France*, 167 ARCHIVES INTERNAL MED. 2177 (2007); Jean-François Dhainaut et al., *Unprecedented heat-related deaths during the 2003 heat wave in Paris: consequences on emergency departments*, 8 CRITICAL CARE 1 (2004).

July 1995, Chicago experienced a heat wave that resulted in more than 600 excess deaths, 3,300 excess emergency department visits, and a significant increase in intensive care unit admissions for heat stroke.[16] And a 2006 California heat wave was associated with over 16,000 excess visits to the emergency room and 1,182 excess hospitalizations.[17]

Certain factors exacerbate the mortality impacts of heat waves. First, such effects are more severe in cities due to the "heat island" effect of concrete surfaces heating faster and holding heat longer than non-urban areas.[18] Second, areas unaccustomed to high temperatures experience higher mortality rates from heat waves.[19] Finally, mortality rates increase as heat waves become longer and hotter.[20]

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[16] Jane E. Dematte, et al., *Near-fatal heat stroke during the 1995 heat wave in Chicago*, 129 ANNALS OF INTERNAL MED. 173 (1998).
[17] Kim Knowlton et al., *The 2006 California heat wave: Impacts on hospitalizations and emergency department visits*, 117 ENVTL. HEALTH PERSPECTIVES 61 (2009).
[18] Jonathan A. Patz et al., *Impact of regional climate change on human health*, 438 NATURE 310, 310 (2005); *see generally* C.J.G. Morris & I. Simmonds, *Associations between varying magnitudes of the urban heat island and the synoptic climatology in Melbourne, Australia*, 20 INT'L J. CLIMATOLOGY 1931 (2000).
[19] William N. Rom & Kent E. Pinkerton, *Introduction: Consequences of Global Warming to the Public's Health*, in *Global Climate Change and Public Health* 1, 10 (Kent E. Pinkerton & William N. Rom eds., 2014); G. Brooke Anderson & Michelle L. Bell, *Weather-related mortality: how heat, cold, and heat waves affect mortality in the United States*, 20 EPIDEMIOLOGY 205 (2009); Lauraine G. Chestnut et al., *Analysis of differences in hot-weather-related mortality across 44 US metropolitan areas*, 1 ENVTL. SCI. & POL'Y 59 (1998).
[20] Daniela D'Ippoliti et al., *The impact of heat waves on mortality in 9 European cities: results from the EuroHEAT project*, 9 ENVTL. HEALTH, July 16, 2010.

As climate change causes more frequent, persistent and severe heat waves, in unprecedented places, these mortality effects will be amplified.

Heat waves also cause a number of other non-fatal but serious health effects. These include heat stroke[21] and hospitalization for heart or lung disease.[22] There is evidence that extreme heat may trigger hospitalizations for congestive heart failure,[23] and that acute increases in temperature and humidity are associated with increased emergency department visits and hospitalizations for asthma in children and adults.[24] For example, a study of 12.5 million Medicare beneficiaries found

[21] Melanie Boeckmann & Ines Rohn, *Is heat adaptation in urban areas reducing heat stroke incidence and cardiovascular mortality? A systematic review of the literature*, 23 EUR. J. PUB. HEALTH (Supp. 1) 198, 199 (2013); R. Sari Kovats & Shakoor Hajat, *Heat stress and public health: a critical review*, 29 ANNUAL REV. PUB. HEALTH 41, 42, 47 (2008) (noting danger of and risk factors for heat stroke).
[22] *See* 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) (summarizing relevant research and describing pathways through which high temperatures can lead to adverse health outcomes); Anthony J. McMichael et al., *Climate change and human health: present and future risks*, 367 THE LANCET 9513, at 861 (2006) ("Most heatwave deaths occur in people with pre-existing cardiovascular disease (heart attack and stroke) or chronic respiratory disease).
[23] *See* Youn-Hee Lim, et al., *Effects of diurnal temperature range on cardiovascular and respiratory hospital admissions in Korea*, 417 SCIENCE OF THE TOTAL ENV'T 55 (2012).
[24] *See* Nana Mireku, *et al*. *Changes in weather and the effects on pediatric asthma exacerbations*, 103 ANNALS OF ALLERGY, ASTHMA & IMMUNOLOGY 220-24 (2009); *see also* Lim, *et al*., *supra* n. 23.

that each 10°F increase in daily temperature was associated with a 4.3% increase in same-day emergency hospitalizations for respiratory diseases.[25]

The simple stress of hotter weather, independent of acute heat waves, can also increase mortality.[26] Further, warming trends allow for increases in vectors carrying harmful diseases. Higher temperatures expand the range of environments suitable to disease-carrying species,[27] and contribute to a rise in extreme weather events that produce conditions conducive to clusters of water-, mosquito- and rodent-borne diseases.[28]

Rising temperatures due to carbon emission-fueled climate change are therefore expected to have continued widespread, dangerous health impacts. While demographic shifts and adaptation may alleviate some of these impacts over time,[29]

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[25] *See* G. Brooke Anderson, *et al*. *Heat-related emergency hospitalizations for respiratory diseases in the Medicare population*, 187 AM. J. RESPIR. CRIT. CARE MED. 1098 (2013).

[26] Shakoor Hajat et al., *Impact of high temperatures on mortality: is there an added heat wave effect?*, 17 EPIDEMIOLOGY 632 (2006) (examining summer mortality rates and finding that generally higher temperatures, rather than heat waves, accounted for most deaths).

[27] *See, e.g.*, 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 4 (2013).

[28] *See, e.g.*, Paul Epstein, *The ecology of climate change and infectious diseases: comment*, 91 ECOLOGY 925 (2010).

[29] *See generally, e.g.*, *The Demography of Adaptation to Climate Change* (Martine, George and Daniel Schensul, eds.), New York, London and Mexico City: UNFPA, IIED and El Colegio de México (2013).

large segments of the American population are expected to suffer or die as a consequence of greenhouse gas emissions and resultant heat waves.

B. Ozone and Particulate Matter

Climate change also has a number of effects on air quality that are harmful to human health,[30] including the promotion of higher concentrations of ground level ozone and particulate matter. Ground level ozone is created through a photo-chemical reaction between nitrogen oxides, volatile organic compounds, and sunlight.[31] Warmer temperatures that come with higher atmospheric concentrations of greenhouse gases increase ground level ozone production.[32] Those warmer temperatures also lead to longer dry seasons, decreased snowpack, and earlier snowmelt, all of which are factors for increased and more intense wildfire.[33]

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[30] Kim Knowlton et al., *Assessing Ozone-Related Health Impacts under a Changing Climate*, 112 ENVTL. HEALTH PERSPS. 1557, 1559-60, 1562 (2004) (estimating significant increase in mortality by 2050 as a result of increase in ground-level ozone attendant to climate change).

[31] *See, e.g.*, U.S. Environmental Protection Agency, "Ozone Pollution," https://www.epa.gov/ozone-pollution (last visited March 26, 2016).

[32] Jonathan A. Patz, *Climate Change and Health: New Research Challenges*, 6 ECOSYSTEM HEALTH 52 (2000) (identifying strong positive association between ozone formation and ambient temperatures above 90°F/32°C); Levinson & Fettig, *supra* n. 12; Jacob & Winner, *supra* n. 6; Ivar Isaksen et al., *Atmospheric composition change: Climate-Chemistry interactions*, 43 ATMOSPHERIC ENVIRONMENT 5138 (2009).

[33] Xu Yue et al., *Ensemble projections of wildfire activity and carbonaceous aerosol concentrations over the western United States in the mid-21st century*, 77 ATMOSPHERIC ENV'T 767, 768, 779 (2013); Anthony L. Westerling & Benjamin P. Bryant, *Climate change and wildfire in California*, 87 CLIMATE CHANGE (Supp. 1) S231, S231-32 (2008) (describing relationship between reduced precipitation and

Wildfires lead to direct loss of life and property damage and release a range of pollutants at high concentrations, from particulate matter, ozone and acrolein (a respiratory irritant) to carcinogens such as formaldehyde and benzene.[34] These pollutants can drift hundreds of miles downwind from the blaze.

Climate change-induced increases in ground level ozone and particulate matter have negative consequences for human health. Air pollution from ground level ozone and particulate matter has been linked to cardiovascular disease,[35] both independently and combined. Ground level ozone, a lung and airway irritant, is a well-known cause of cardiovascular and respiratory injury and death.[36] People

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snowpack, earlier snowmelt, warmer spring and summer seasons, and fire frequency).

[34] Hassani Youssouf, et al., 11 *Non-Accidental Health Impacts of Wildfire Smoke*, INT'L J. ENVTL. RES. & PUBLIC HEALTH, 11772, 11773 (2014); Daniel A. Jaffe & Nicole L Wigder, *Ozone production from wildfires: A critical review*, 51 ATMOSPHERIC ENV'T 1, 2, 7 (2012); Teresa C. Wegesser et al., *California Wildfires of 2008: Coarse and Fine Particulate Matter Toxicity*, 117 ENVTL. HEALTH PERSPS. 893, 895–96 (2009) (describing greater toxicity of PM generated by wildfire as comparable to breathing ten times the level of the PM found in California's ambient air under normal conditions); Gabriele Pfister et al., *Impacts of the fall 2007 California wildfires on surface ozone: Integrating local observations with global model simulations*, 35 GEOPHYSICAL RES. LETTERS L19814 (2008).

[35] Robert D. Brook, et al., *Air Pollution and Cardiovascular Disease*, 109 CIRCULATION 2655-2671 (2004); Robert D. Brook et al., *Particulate Matter Air Pollution and Cardiovascular Disease*, 121 CIRCULATION 2331-2378 (2010).

[36] Michelle L. Bell et al., *A Meta-Analysis of Time-Series Studies of Ozone and Mortality with Comparison to the National Morbidity, Mortality, and Air Pollution Study*, 16 EPIDEMIOLOGY 436, 442 (2005); Kazuhiko Ito et al., *Associations Between Ozone and Daily Mortality: Analysis and Meta-Analysis*, 16 EPIDEMIOLOGY 446, 455 (2005); Richard L. Smith et al., *Reassessing the*

suffering from pre-existing lung disease are particularly susceptible to the harmful health effects of ozone exposure. Studies have found that even modest and relatively brief increases in ground-level ozone are linked to deterioration in asthma control, and increased risk of acute care visits and hospitalization for patients with asthma and chronic obstructive pulmonary disease.[37] Decreases in air quality from wildfires are similarly associated with increased hospitalization for lung disease (in particular, asthma attacks and acute episodes of chronic obstructive pulmonary disease)[38] and congestive heart failure.[39]

There is also strong evidence that exposure to ground level ozone and particulate matter increases risk of death, even for those without preexisting

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relationship between ozone and short-term mortality in U.S. urban communities, 21 INHALATION TOXICOLOGY 37 (2009) (noting inter-regional variation in ozone risk thresholds).

[37] *See* Benedicte Jacquemin, et al. *Air pollution and asthma control in the Epidemiological study on the Genetics and Environment of Asthma*, 66 J. EPIDEMIOLOGY COMMUNITY HEALTH 796-802 (2012); Kelly Moore, et al., *Ambient ozone concentrations cause increased hospitalizations for asthma in children: an 18-year study in Southern California*, 116 ENVTL. HEALTH PERSPECTIVES 1063-70 (2008); Steven M. Babin *et al*., *Pediatric patient asthma-related emergency department visits and admissions in Washington, DC, from 2001-2004, and associations with air quality, socio-economic status and age group*, 6 ENVTL. HEALTH 1-11 (2007); Fanny W.S. Ko, *et al*., *Temporal relationship between air pollutants and hospital admissions for chronic obstructive pulmonary disease in Hong Kong*, 62 THORAX 780-85 (2007); Bert Brunekreef, et al., *Air pollution and health*, 360 THE LANCET 1233-42 (2002).

[38] Henderson et al., *supra* n. 6.

[39] Ana G. Rappold et al., *Peat Bog Wildfire Smoke Exposure in Rural North Carolina is Associated with Cardiopulmonary Emergency Department Visits Assessed through Syndromic Surveillance*, 119 ENVTL. HEALTH PERSPS. 1415, 1415-18 (2011).

conditions.[40] For instance, one multi-city study found that for each 10 μg/m^3 increase in atmospheric ozone level in heat-wave conditions, there was a one percent increase in mortality rates.[41] It is, therefore, expected that rising temperatures due to greenhouse gas emissions will result in increased ozone formation and ozone-associated increases in morbidity and mortality.[42] Moreover,

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[40] **Ozone:** Roger D. Peng, et al., *Acute effects of ambient ozone on mortality in Europe and North America: results from the APHENA study*, 6 AIR QUALITY ATMOSPHERIC HEALTH 445-53 (2013); Mercedes Medina-Ramón & Joel Schwartz, *Who is more vulnerable to die from ozone air pollution?* 19 EPIDEMIOLOGY 672-79 (2008). **PM:** Ana G. Rappold et al., *Cardio-respiratory outcomes associated with exposure to wildfire smoke are modified by measures of community health*, 11 ENVTL. HEALTH, Sept. 24, 2012; Rappold et al., *Peat Bog Wildfire Smoke Exposure*, *supra* n. 39 at 1415-18 (2011); Fay H. Johnston et al., *Estimated Global Mortality Attributable to Smoke from Landscape Fires*, 120 ENVTL. HEALTH PERSPS. 695, 695 (2012) (estimating that inhalation of smoke from landscape fires worldwide leads to approximately 339,000 deaths annually); Laura Perez et al., *Saharan dust, particulate matter and cause-specific mortality: A case-crossover study in Barcelona (Spain)*, 48 ENV'T INT'L 150, 152 (2012); 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 ENVTL. HEALTH PERSPS. 965, 968 (2012); U.S. ENVTL. PROT. AGENCY, EXPANDED EXPERT JUDGMENT ASSESSMENT OF THE CONCENTRATION-RESPONSE RELATIONSHIP BETWEEN PM2.5 AND MORTALITY: FINAL REPORT vii, 3-20 to 3-24 (2006).

[41] Laurent Filleul et al., *The relation between temperature, ozone and mortality in nine French cities during the heat wave of 2003*, 114 ENVTL. HEALTH PERSPS. 1344, 1345 (2006); Cizao Ren et al., *Ozone modifies associations between temperature and cardiovascular mortality: analysis of the NMMAPS data*, 65 J. OCCUPATIONAL & ENVTL. MED. 255, 260 (2008) (identifying similarly synergistic effect in different data set).

[42] *See, e.g.*, Knowlton et al., *supra* n. 30, at 1559-60, 1562.

heat and air pollution appear to be synergistic, meaning they do more harm combined than separate.[43]

C. Pollen and Microbial Hazards

Climate change promotes increased exposure to pollen, fungi, and other microbial growth, with adverse consequences for human health. First, rising global temperatures are increasing both the duration and intensity of pollen seasons. Warmer temperatures lengthen the pollen season because plants bloom earlier in the spring.[44] For instance, between 1995 and 2009, the ragweed pollen season lengthened 13-27 days above the 44th parallel, which cuts through the northern United States.[45] At the same time, increases in carbon dioxide levels and temperature cause plants to generate greater amounts of pollen.[46] And climate change is associated with more frequent and severe thunderstorms, which can

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[43] Zhengmin Qian et al., *High Temperatures Enhanced Acute Mortality Effects of Ambient Particle Pollution in the "Oven" City of Wuhan, China*, 116 ENVTL. HEALTH PERSPS. 1172 (2008); Cizao Ren et al., *Does particulate matter modify the association between temperature and cardiorespiratory diseases?*, 114 ENVTL. HEALTH PERSPS. 1690 (2006); Klea Katsouyanni et al., *Evidence for interaction between air pollution and high temperature in the causation of excess mortality*, 48 ENVTL. HEALTH 235, 240 (1993).

[44] Ilginc Kizilpinar et al., *Pollen counts and their relationship to meteorological factors in Ankara, Turkey during 2005–2008*, 55 INT'L J. BIOMETEOROLOGY 623, 629-30 (2011); Julie Wolf et al., *Elevated atmospheric carbon dioxide concentrations amplify Alternaria alternata sporulation and total antigen production*, 118 ENVTL. HEALTH PERSPS. 1223 (2010).

[45] Ziska, *Recent warming*, *supra* n. 7 at 4248-51.

[46] Kizilpinar *et al.*, *supra* n. 44 *at* 629-30; Wolf, *et al.*, *supra* n. 44 at 1223.

cause sudden pollen releases.[47] Increases in heavy rainfall will in turn increase flooding in low-lying areas, and contribute to mold and microbial growth.[48] All of these impacts have negative consequences for public health.

Pollen can cause allergic disease symptoms.[49] Currently, higher pollen counts impair the quality of life of at least 16.9 million Americans and impose substantial costs on the health care system.[50] Longer allergy seasons increase this burden.[51] Higher pollen levels are also associated with lung inflammation,[52] which

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[47] Shuaib M. Nasser & Thomas B. Pulimood, *Allergens and Thunderstorm Asthma*, 9 CURRENT ALLERGY & ASTHMA REP. 384, 387-88 (2009); A.E. Dennis Wardman et al., *Thunderstorm-associated asthma or shortness of breath epidemic: A Canadian case report*, 9 CANADIAN RESPIRATORY J. 267 (2002).

[48] *See, e.g.*, Margaret A. Riggs, et al., *Resident cleanup activities, characteristics of flood-damaged homes and airborne microbial concentrations in New Orleans, Lousiana, October 2005*, 3 ENVTL. RESEARCH 106, 402, 404-05 (2005).

[49] *See, e.g.*, Lyndsey A. Darrow et al., *Ambient pollen concentrations and emergency department visits for asthma and wheezing*, 130 J. ALLERGY & CLINICAL IMMUNOLOGY 630 (2012); Léa Héguy et al., *Associations between grass and weed pollen and emergency department visits for asthma among children in Montreal*, 106 ENVTL. RES. 203 (2012) (linking pollen to asthma exacerbation); Perry E. Sheffield et al., *The Association of Tree Pollen Concentration Peaks and Allergy Medication Sales in New York City: 2003–2008*, 2011 ISRN Allergy, no. 537194, at 1, 4–6 (identifying clear relationship between consumption of allergy medication and local pollen concentrations).

[50] Susan M. Schappert & Elizabeth A. Rechtsteiner, CDC, Nat'l Ctr. for Health Stats., *Ambulatory medical care utilization estimates for 2007*, Vital Health Stats., ser. 13, no. 169, at 23 tbl.7 (2011) (tallying ambulatory care visits owing to allergic rhinitis); Robert A. Nathan, *The burden of allergic rhinitis*, 28 ALLERGY & ASTHMA PROC. 3 (2007) (describing symptoms, impacts on quality of life, and costs of treatment).

[51] *See, e.g.*, Yong Zhang et al., *Allergic pollen season variations in the past two decades under changing climate in the United States*, 21 GLOBAL CHANGE BIOLOGY 1581, 1583-86 (2015); Kizilpinar *et al.*, *supra* n. 44, at 629-30.

can cause upper and lower respiratory tract symptoms, even among those who do not suffer from allergic asthma, allergic rhinitis, or hay fever.[53]

Longer allergy seasons also promise difficulties for the 8.4 percent of Americans—25.7 million people—who suffer from asthma, because pollen can trigger asthma attacks.[54] This includes nearly 10 percent of American children.[55] Numerous studies have found increases in asthma and wheeze-related emergency room visits when pollen levels are heightened.[56] Asthma exacerbations are dangerous and frightening, often requiring medical attention, including emergency treatment. These asthma attacks can also result in disability, including loss of

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[52] Aliz Varga et al., *Ragweed pollen extract intensifies lipopolysaccharide-induced priming of NLRP3 inflammasome in human macrophages*, 138 IMMUNOLOGY 392 (2012).

[53] Anthony M. Szema, *Asthma, Hay Fever, Pollen, and Climate Change, in* GLOBAL CLIMATE CHANGE AND PUBLIC HEALTH 155, 156 (Kent E. Pinkerton & William N. Rom eds., 2014).

[54] *See* Jeanne E. Moorman et al., Center for Disease Control, Nat'l Ctr. for Health Stats., *National Surveillance of Asthma: United States, 2001–2010*, Vital Health Stats. ser. 3, no. 35, at 3-4 (2012).

[55] *See Asthma Statistics*, AM. ACADEMY OF ALLERGY ASTHMA & IMMUNOLOGY, http://www.aaaai.org/about-aaaai/newsroom/asthma-statistics (last visited March 23, 2016).

[56] *See* Darrow et al., *supra* n. 49; Bircan Erbas et al., *The role of seasonal grass pollen on childhood asthma emergency department presentations*, 42 CLINICAL & EXPERIMENTAL ALLERGY 799-85 (2012); Héguy, et al., *supra* n. 49 at 203-11; Wei Zhong et al., *Analysis of short-term influences of ambient aeroallergens on pediatric asthma hospital visits*, 370 SCIENCE OF THE TOTAL ENVIRONMENT 330-36 (2006).

school and work, for days.[57] Recurrent exacerbations can cause permanent airway damage and often require costly medical care.[58]

Continued greenhouse gas emissions and their effects on pollen productivity and prolongation of the pollen season are expected to increase risk and severity of asthma attacks[59] as well as the likelihood of allergic disease from mold and other microbial growth.[60]

D. Vulnerable Populations Will be the Hardest Hit by Climate Change

Children younger than five, adults older than sixty-five, low-income individuals and communities of color are most vulnerable to the adverse health impacts of climate change given their reduced resilience to health hazards. [61] These populations are at greatest risk of developing both chronic and acute

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[57] Susan M. Pollart et al., *Management of acute asthma exacerbations*, 84 AM. FAMILY PHYSICIAN 40 (2011); Mary E. Strek, *Difficult asthma*, 3 PROC. AM. THORACIC SOC'Y 116 (2006); E.R. McFadden, Jr., *Acute Severe Asthma*, 168 AM. J. RESPIRATORY & CRITICAL CARE MED. 740 (2003).

[58] 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).

[59] Lorenzo Cecchi et al., *Projections of the effects of climate change on allergic asthma: the contribution of aerobiology*, 65 ALLERGY 1073 (2010).

[60] Institute of Medicine, DAMP INDOOR SPACES AND HEALTH, The National Academies Press, Washington, DC (2004).

[61] *See, e.g.*, Intergovernmental Panel on Climate Change 2014: Chapter 11.3, "Vulnerability to Disease and Injury Due to Climate Variability and Climate Change," in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Field, Christopher B., et al., eds.), Cambridge University Press (2014).

illnesses from climate-related environmental factors. Further, research has documented substantial burdens of anxiety disorders and post-traumatic stress disorder after extreme weather events such as severe storms and wildfires.[62]

Children, particularly infants, are more susceptible to climate change-related temperature increases[63] and heat waves because they cannot regulate body temperature as well as adults below sixty-five years of age.[64] Moreover, as noted, climate change will worsen air quality, and children are more susceptible to harms posed by air pollutants because they generally spend more time outdoors, have higher respiratory rates, and have developing organs and immune systems.[65] Exposure of children to decreased air quality is associated with chronic respiratory

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[62] Richard A. Bryant et al., *Psychological outcomes following the Victorian Black Saturday bushfires*, 48 AUST. & NZ J. PSYCHIATRY (July 2014); Sarah R. Lowe, et al., *Health problems among low-income parents in the aftermath of Hurricane Katrina*, 33 HEALTH PSYCHOLOGY 774-82 (2014).

[63] Xiaofang Ye et al., *Ambient Temperature and Morbidity: A Review of Epidemiological Evidence*, 120 ENVTL. HEALTH PERSPS. 19, 26 (2012) (noting that rates of hospital admissions reflect greater temperature-related risks for children and elderly); Knowlton et al., *supra* note 17, at 61 (observing greater risk of heat-related emergency department visits for children ages 0–4); Rupa Basu & Bart D. Ostro, *A multicounty analysis identifying the populations vulnerable to mortality associated with high ambient temperature in California*, 168 AM. J. EPIDEMIOLOGY 632, 634 (2008) (identifying heightened mortality risk for infants younger than one year).

[64] Margolis, *supra* n. 22, at 102.

[65] Janice J. Kim et al., *Ambient Air Pollution: Health Hazards to Children*, 136 PEDIATRICS 5:992-7 (2015); Roya Kelishadi & Parinaz Poursafa, *Air pollution and non-respiratory health hazards for children*, 6 ARCHIVES MED. SCI. 483, 484 (2010).

illnesses,[66] chronic non-respiratory illnesses,[67] and asthma-related hospitalizations.[68] For example, a disproportionate number of pediatric asthma-related hospitalizations and ICU admissions have occurred during days with high levels of ground level ozone in New York City.[69] Combating harmful health impacts is not a matter of simple avoidance, as efforts to protect children from poor air quality can reduce their access to needed physical activity to help prevent obesity.

Adults sixty-five and older also face heightened health risks from climate change. They are more likely to be hospitalized or to die from high temperatures and heat waves.[70] They often have marginal cardio-respiratory reserves to cope

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[66] Gennaro D'Amato *et al.*, *Urban Air Pollution and Climate Change as Environmental Risk Factors of Respiratory Allergy: An Update*, 20 J. INVESTIGATIONAL ALLERGOLOGY AND CLINICAL IMMUNOLOGY 95 (2010); Gennaro D'Amato *et al.*, *Effects of climate change on environmental factors in respiratory allergic diseases*, 38 CLINICAL AND EXPERIMENTAL ALLERGY 1264 (2008).

[67] Kelishadi & Poursafa, *supra* n. 65.

[68] *See*, *e.g.*, Mireku et al., *supra* n. 24, at 223-24; Katherine Shea, *Global Climate Change and Children's Health*,120 PEDIATRICS 1359 (2007).

[69] Robert A. Silverman, et al., *Age-related association of fine particles and ozone with severe acute asthma in New York City*, 125 J. Allergy & Clinical Immunology 367-373 (2010).

[70] Janet L. Gamble et al., *Climate Change and Older Americans: State of the Science*, 121 ENVTL. HEALTH PERSPS. 15 (2013); Antonella Zanobetti et al., *Summer temperature variability and long-term survival among elderly people with chronic disease*, 109 PROC. NAT'L ACAD. SCI. 6608 (2012); Rupa Basu, *High ambient temperature and mortality: a review of epidemiologic studies from 2001 to 2008*, 8 ENVTL. HEALTH, Sept. 16, 2009; Massimo Stafoggia et al., *Factors affecting in-hospital heat-related mortality: a multi-city case-crossover analysis*, 17 EPIDEMIOLOGY 315 (2006).

during heat and air pollution events, and are expected to experience more frequent acute cardiovascular and respiratory illnesses from climate change-related increases in heat and pollution.[71] Low-income individuals are also often less equipped to adapt to climate stressors. In particular, low-income urban communities of color, who already have elevated rates of asthma, diabetes and chronic cardiovascular disease, and are more heavily exposed to air pollution than people in rural environments, are among those most exposed to extreme heat, due to urban heat island effects and reduced access to cooling.[72] In addition, they often have reduced access to alternate housing, food, or transportation in the event of a weather emergency. African-American physicians, who see higher proportions of patients from communities of color and low-income communities, report higher rates of all climate-related health conditions than other physicians.[73]

[71] G. Brooke Anderson et al., *supra* n. 25 ; Lim et al., *supra* note 23, at 56-57, 60.
[72] See Ganlin Huang, et al., *Is everyone hot in the city? Spatial pattern of land surface temperatures, land cover and neighborhood socioeconomic characteristics in Baltimore City, MD*, 92 J. ENVTL. MGMT. 1753-59 (2011); Barry S. Levy, et al., *Climate Change, Human Rights, and Social Justice,* 81 Annals of Global Health 310-22 (2015).
[73] Mona Sarfaty et al., *A survey of African-American Physicians*, *supra* n.2 at 12473-85.

II. By Addressing Both Carbon Emissions Responsible for Climate Change and Conventional Air Pollutants, EPA's Clean Power Plan Carries Out the Clean Air Act's Mandate to Protect the Public Health.

Greenhouse gas pollution and resulting climate change will have severe impacts on human health for all of the reasons stated.[74] And even without the exacerbating impacts of climate change, conventional air pollutants like ozone, particulate matter, nitrogen oxide and sulfur dioxide have significant negative consequences for human health.[75] The Clean Power Plan, which will result in direct reductions of both carbon emissions and conventional air pollutants, is a legitimate fulfillment of EPA's statutory obligations.

Avoidance of health harms from air pollution is a governing principle of the CAA, as evidenced by the Act's stated objective "to protect and enhance the quality of the Nation's air resources so as to promote the public health." 42 U.S.C. § 7401 (2015). The legislative history of Congress's multiple amendments of the CAA between 1970 and 1990 similarly manifests a consistent Congressional belief that the Act is critical to protecting human health.

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[74] Climate change will also result in health impacts from factors not discussed here such as frequent and intense storms, rising sea levels, changing agricultural and fishery yields, drought, dust storms, and human migration.

[75] *See, e.g.*, Drew T. Shindell et al., *Climate and health impacts of US emissions reductions consistent with 2 ℃*, NATURE CLIMATE CHANGE, Letter, *available at* http://www.nature.com/nclimate/journal/vaop/ncurrent/full/nclimate2935.html (last visited March 28, 2016).

During floor consideration of the conference report to the 1970 Clean Air Act Amendments, Senator Edmund Muskie, the Senate architect of the legislation, said the Act would "enable the country to clean up the air and protect the public health," noting that the costs of air pollution had been counted to date "in death, disease, and disability." 116 CONG. REC. S20,597 (1970). In 1977, Congress amended the CAA again, Clean Air Act Amendments of 1977, Pub. L. No. 95-95, 91 Stat. 685 (1977), and again concern with human health was the driving force behind the legislation. Representative Henry Waxman, one of the House conferees, said "[i]t is important for my colleagues to remember the purpose of the Clean Air Act: to protect the health of the American people . . . [i]t is a matter, for some, of life and death. . . . For others, it is a question of increased rates of respiratory and heart disease." 123 CONG. REC. H8,668 (1970).

Concerns about the human health costs of pollution motivated Congress to amend the Clean Air Act again in 1990. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (1990). The conference report for those amendments noted the CAA was being amended "to provide for the attainment and maintenance of health protective national ambient air quality standards." H.R. CONF. REP. 101-952, *3,867 (1990). During Senate consideration of the conference report, Senator Lincoln Chafee, who introduced the legislation in the Senate, and was the ranking member of the committee of jurisdiction for the legislation, said

"[t]his is a health bill." 136 CONG. REC. S16895. Senator Chris Dodd, at the same time, also suggested that the 1990 CAA Amendments were intended to help respond to future health challenges by noting that they will "provide a good starting point for protecting public health . . . resources well into the next century." *Id. at* S17764 (1990). This legislative history establishes that Congress repeatedly amended the CAA to provide EPA the authority to regulate air pollution because the bill's supporters were deeply concerned that unmitigated air pollution was causing and would cause deadly and severe health challenges for Americans.

To address those goals, EPA is required by the CAA to regulate pollutants that endanger public health and welfare. That obligation has been recognized repeatedly by the Supreme Court. In *Massachusetts v. EPA*, 549 U.S. 497 (2007), the Supreme Court found that carbon emissions are "air pollutants" under the CAA, and that EPA must regulate carbon emissions if it determines that they contribute to climate change and endanger public health. As prompted by the Court, EPA made an endangerment finding in 2009. It is therefore now under a legal obligation to regulate carbon emissions. Further, in *American Electric Power v. Connecticut*, 564 U.S. 410, 131 S. Ct. 2527, 2537 (2011), the Court made clear that the CAA "speaks directly" to emissions of carbon dioxide from fossil-fuel fired power plants.

Fossil fuel-fired power plants are the largest source of carbon emissions in the United States.[76] The reductions in emissions of both carbon and conventional pollutants that will result from the Clean Power Plan[77] reinforce ongoing market trends, and will reduce the negative consequences for health described in this brief. This is precisely the intent of the CAA. The Clean Power Plan therefore fulfills EPA's obligations as outlined by the Supreme Court.

Petitioners assert that language in the United States Code version of 42 U.S.C. 7411, § 111(d) of the CAA, prohibits EPA from regulating carbon emissions through that section. *See* Pet. Brief (Core Legal Issues), Doc. No. 1599889, at 29-31. Resolution of the parties' arguments over § 111(d) should be informed in part by the Supreme Court's whole act rule, which instructs the reviewing court, in interpreting legislation, not to let part of a sentence in a statute defeat the broader object and policy of the whole law. *Richards v. United States*, 369 U.S. 1, 11 (1962). Courts can look to legislative history to determine the object and purpose of a statute in applying the whole act rule. *Concrete Pipe & Prods of Cal. Inc. v. Constr. Laborers Pension Trust for S. Cal.*, 508 U.S. 602 (1993).

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[76] Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014 ES-8 (February 2016), *available at* https://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2016-Main-Text.pdf (last visited March 24, 2016).

[77] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. at 64,667.

The policy and legislative history of the CAA demonstrate that it was designed with human health in mind. The Clean Power Plan will regulate and reduce emissions of carbon, an air pollutant. In doing this, it will deliver benefits for human health by reining in climate change and its associated harmful impacts. Thus, the Clean Power Plan resolves the very types of harms that motivated Congress to pass the CAA in 1970 and then to amend it in 1977 and again in 1990. The Court should interpret § 111(d) through the lens of those goals.

CONCLUSION

For the foregoing reasons, *amici* urge this Court to protect the health of Americans for generations to come by finding that the Clean Power Plan constitutes a lawful exercise of EPA's authority under § 111(d).

Respectfully submitted,

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Dated: April 1, 2016

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CERTIFICATE OF COMPLIANCE

This motion complies with Federal Rules of Appellate Procedure 27(d)(1)&(2) because it meets the prescribed format requirements and contains 6,771 words. This motion also 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)(5)&(6) because it has been prepared in a proportionally spaced typeface using Microsoft Word in 14-point Times New Roman.

Dated: April 1, 2016

/s/ Sarah J. Fox

Sarah J. Fox

CERTIFICATE OF SERVICE

I hereby certify that on April 1, 2016, I filed the foregoing document in person with the Clerk of the Court for the United States Court of Appeals for the District of Columbia. I also electronically filed the foregoing document with the Clerk of the Court for the United States Court of Appeals for the District of Columbia Circuit using the appellate CM/ECF system for service on all registered counsel in these consolidated cases.

Dated: April 1, 2016

/s/ Sarah J. Fox

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