



October 31, 2018

The Honorable Andrew Wheeler
Acting Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Submitted via Regulations.gov

RE: Proposals by the U.S. Environmental Protection Agency for: Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program. Docket EPA-HQ-OAR-2017-0355

Dear Acting Administrator Wheeler:

As representatives of the medical and public health community, our organizations wish to share our joint comments on the U.S. Environmental Protection Agency's proposals listed above: the replacement of the Clean Power Plan with the proposed Emission Guidelines for Existing Electric Utility Generating Units, commonly referred to as the Affordable Clean Energy (ACE) rule; the proposed revisions to emission guideline implementing regulations; and the proposed revisions to the New Source Review (NSR) Program.

Climate change poses grave threats to public health. To protect our communities and the public, the United States must significantly reduce carbon pollution from the largest stationary source, which is the nation's fleet of existing power plants. Our organizations oppose EPA's proposal to replace the Clean Power Plan with the ACE proposed rule and urge EPA to implement the Clean Power Plan to protect

public health as required under the Clean Air Act. Our organizations also oppose the proposed revisions to the NSR program. We urge EPA to withdraw the proposal.

Climate change poses serious threats to human health.

The changing climate threatens the health of Americans alive now and in future generations. Carbon dioxide lasts in the atmosphere for hundreds of years, altering climate in damaging ways. Time is of the essence in curbing releases of this pollution if we are to avoid catastrophic damage. Consequently, the nation has a short window to act to reduce those threats.

Since EPA finalized the Clean Power Plan in 2015, hundreds of additional studies and major reports have made even clearer the essential need to adopt and maintain the strongest possible measures to reduce carbon and other greenhouse gases that endanger the long-term health of all people.¹

Earlier this month, the United Nations Intergovernmental Panel on Climate Change (IPCC) released their latest conclusions underlining the impact of climate change on the world now and in the future.² The report confirms that actions underway now will not be enough to protect against the ongoing and growing risk to public health: more, stronger, faster steps must be taken. They warn the world that the growing, disastrous consequences of failing to curtail climate change are happening more rapidly than countries are preparing to tackle. They sought to reach conclusions on the impact of a much lower heat increase (1.5° C), compared with the 2° C increase that the Paris Agreement had accepted as a target for reducing carbon emissions.

Based on current estimates, the scientists predict that even if the warming is limited to 1.5° C between 2030 and 2052, it will create significant harm; that is, risks to health and the environment will occur well in advance of the direr harms forecasted for meeting the target of 2° C global warming at the century's end. The report documented the current impact of warmer temperatures in data collected around the world and in assessment of the impact of the 1° C rise the world has already experienced since pre-industrial times. They describe some of the evidence of harm to human health, including increased heat and increased risk of higher ozone, as well as increased risk of vector-borne diseases, and the greater risks facing low-income people around the globe. As one author of the report explained:

“One of the key messages that comes out very strongly from this report is that we are already seeing the consequences of 1° C of global warming through more extreme weather, rising sea levels and diminishing arctic ice, among other changes.”³

The threat that this will increase comes not at the end of the century, but now, and it will likely get worse, they warn:

“Extra warming on top of the ~1° C we have seen so far would amplify the risks and associated impacts, with implications for the world and its inhabitants. This would be the case even if the total warming is held at 1.5° C, just half a degree above where we are now, and would be further amplified at 2° C global warming.”⁴

The IPCC provided strong recommendations of more aggressive actions needed to reduce greenhouse gas emissions, including greatly reduced coal use and increased use of clean, renewable energy sources. The IPCC recognized that a limited approach would fail to provide anywhere close to the protections needed under the current levels. As one co-chair of one of the working groups describes the risk: “Every extra bit of warming matters, especially since warming of 1.5° C or higher increases the risk associated with long-lasting or irreversible changes.”⁵

In addition to the IPCC report, the National Climate Assessment provides further evidence of climate change and its impact. Last year, the fourth and most recent National Climate Assessment, a report of the U.S. Global Change Research Program, confirmed and updated estimates of the impact of the changing climate in the United States. The report concluded again that climate change is demonstrably real and caused by human activities.

“The global, long-term, and unambiguous warming trend has continued during recent years. Since the last National Climate Assessment was published, 2014 became the warmest year on record globally; 2015 surpassed 2014 by a wide margin; and 2016 surpassed 2015. Sixteen of the warmest years on record for the globe occurred in the last 17 years (1998 was the exception).”
“[I]t is extremely likely that human activities, especially emissions of greenhouse gases, are the dominant cause of the observed warming since the mid-20th century. For the warming over the last century, there is no convincing alternative explanation supported by the extent of the observational evidence.”⁶

EPA’s own findings in the Clean Power Plan identified similar threats from climate change on public health:

“GHG pollution threatens the American public by leading to damaging and long-lasting changes in our climate that can have a range of severe negative effects on human health and the environment. . . .

“New scientific assessments since 2009, when the EPA determined that GHGs pose a threat to human health and the environment (the “Endangerment Finding”), highlight the urgency of addressing the rising concentration of CO₂ in the atmosphere. Certain groups, including children, the elderly, and the poor, are most vulnerable to climate-related effects. Recent studies also find that certain communities, including low-income communities and some communities of color (more specifically, populations defined jointly by ethnic/racial characteristics and geographic location), are disproportionately affected by certain climate change related impacts— including heat waves, degraded air quality, and extreme weather events— which are associated with increased deaths, illnesses, and economic challenges. Studies also find that climate change poses particular threats to the health, well-being, and ways of life of indigenous peoples in the U.S.”⁷

These reviews echoed reports previously produced by several of our organizations: the American Academy of Pediatrics’ technical report in 2007 (updated in 2015) on “Global Climate Change and Children’s Health”⁸; the American College of Physicians’ position paper on Climate Change and Health”⁹;

the Asthma and Allergy Foundation of America's *Extreme Allergies and Global Warming*, issued with the National Wildlife Foundation in 2010¹⁰; the American Public Health Association's *Climate Change: Mastering the Public Health Role*, in April 2011¹¹; and the American Thoracic Society's workshop on Climate Change and Human Health published in 2012¹² and report on the global health threat from 2014.¹³ All these reviews arrived at similar conclusions, summarized below.

Ground-level ozone is likely to be worse as the climate warms further and will be harder to clean up in some locations. Higher temperatures increase the likelihood that the precursor gases will react to form ground-level ozone, making it harder to protect people from this most widespread air pollutant. Just this year, in 2018, Los Angeles recorded 87 straight days when ozone levels reached into unhealthy levels, the worst streak of dangerous air pollution levels in 20 years.¹⁴ Researchers repeatedly found that the risk of premature death increased with higher levels of ozone.¹⁵ Ozone causes asthma attacks and respiratory distress, and may increase cardiovascular harm, risk of harm to the central nervous system and the risk of low birth weight in newborns.¹⁶

Wildfires and drought conditions, worsened by the warmer climate, give rise to smoke and dust storms spreading miles from their source. Even more evidence from 2018 showcased the risks from wildfire smoke from blazes in the West. Fires raged in Washington, Oregon, Montana, and especially California, creating severe dangers to health. The fires destroyed homes, forcing relocation. The most extensive threats came from the serious air pollution produced by the smoke. For example, Ojai, California had multiple days in December 2017 when the air quality reached "Very Unhealthy" and "Hazardous" levels.¹⁷ In addition to the lower 48 states, Alaska has seen a decade of increased severe wildfires, a trend expected to continue.¹⁸

Climate-exacerbated drought-driven dust storms also produce elevated levels of particulate matter. The impact of dust storms in recent years demonstrate their power to threaten health in multiple ways, such as the dust storm in Oklahoma in 2012 that shut down Interstate 35, when near-blackout conditions created traffic accidents injuring nine people.¹⁹ Researchers concluded that climate change further worsened the dry soil in California with the increased risk of higher temperatures in the winters of 2013-2014 and 2014-2015.²⁰

Even short-term increases in particle pollution have been linked to premature death from respiratory and cardiovascular causes, including strokes;^{21, 22, 23, 24} increased mortality in infants and young children;²⁵ increased numbers of heart attacks, especially among the elderly and in people with heart conditions;²⁶ increased hospitalization for cardiovascular disease, including strokes and congestive heart failure;^{27, 28, 29} increased risk of low birthweight and preterm births;³⁰ increased hospitalization for asthma among children;^{31, 32, 33} and increased severity of asthma attacks in children.³⁴

Wildfire smoke contains more toxic pollutants than just particulate matter; the smoke mixture includes carbon monoxide, nitrogen oxides, volatile organic compounds and carcinogens as well.³⁵

These examples show that climate change erects new hurdles to our ability to protect health from air pollution. As EPA acknowledged in its 2009 report on the impacts of global climate change on ground-level ozone, modeling for future pollution levels shows the complexity of the problem, with one compelling outcome: climate change had “the potential to make U.S. air quality management more difficult.”³⁶

Extreme weather threatens health. Many cities across the U.S., such as Chicago and Milwaukee, have experienced increased death rates from episodic heat waves in recent years.³⁷ Hotter temperatures can increase the risk of heat stroke and heat exhaustion and the risk of hospitalization for cardiovascular and respiratory diseases.³⁸

Increased risk of dangerous hurricanes threatens not only damage and death from the wind, but disruption in communities that suffer the hurricanes. Just this fall, Hurricanes Florence and Michael have left thousands of families homeless in the aftermath of their massive flooding and wind damage.³⁹ In 2017, Hurricane Maria destroyed Puerto Rico’s infrastructure, resulting in a lack of electricity and damaged roads. As a result, more than 135,000 Puerto Ricans have reportedly moved to the mainland.⁴⁰ As Hurricane Katrina and Super Storm Sandy showed, the disruption can last for years. Hospitals, clinics, medical care and public health services hit by Michael and Maria demonstrate that these facilities may be unable to serve their patients and communities if they are too damaged to provide those services or as resources are diverted to emergency response. Patients find themselves in emergency shelters or relocated to new homes far away from their previous medical caregivers.

The aftermath of Hurricane Harvey left the greater Houston area with more than 50 inches of floodwater, a record rainfall that two studies concluded resulted from the impacts of climate change.⁴¹ Flooding causes premature deaths, often through drowning, but the aftermath of flooding expands the burden. Water damage leaves behind lingering health risks including dampness and mold, chemicals and sewage spread through flood waters, and contaminated debris in flooded homes, schools, hospitals and other community facilities.⁴²

Allergens and risks of vector-borne diseases are already increasing. Warmer weather leads to shifting growing seasons that change flowering time and pollen development and can expand the habitat for allergen-rich plant species. Higher concentrations and longer growing seasons increase the exposure to allergens that trigger asthma and other respiratory and allergic responses.⁴³ In the U.S., spread of diseases such as Lyme, West Nile Virus, and Rocky Mountain spotted fever is linked to complex differences in weather, hosts and human behavior that can be profoundly affected by changes in climate.⁴⁴

Food and water supplies face uncertain challenges. The ongoing drought in California and more recent droughts in the Southeast, including Florida, exemplify the risks associated with a warming climate to the ability to supply adequate water and food supplies to the nation.⁴⁵ As the water levels continue to drop, farmers confront more challenges growing food to supply the rest of the nation and the world.

Certain communities, such as Alaska Natives, may suffer shortages of fresh water and food they have historically hunted or fished.⁴⁶

Psychological stress will complicate response and increase the incidence of mental health issues.

Mental health problems increase after disasters, such as seen after Hurricane Katrina. Moreover, even people with no history of mental health problems, including children, will risk increased stress from responding to and accommodating these severe changes. Among the expected impacts from these stresses are post-traumatic stress disorder; depression and anxiety; increases in violence; and strains due to relocation.⁴⁷

Millions of Americans already suffer greater vulnerability to these threats. Many people will face greater exposure to dangerous air pollution, and associated health risks due to climate change-related high heat events, as documented in the large air pollution science assessments EPA has repeatedly completed. Children face special risks because their bodies are growing and because they are so active.⁴⁸ Older adults are more likely to die during high heat events.⁴⁹ People with chronic respiratory diseases like asthma and chronic obstructive pulmonary disease, people with cardiovascular diseases and people with diabetes also risk greater harm from increased pollution.⁵⁰ Even healthy adults can be affected by increased air pollution, especially if their work requires them to be outdoors, as the study of lifeguards in Galveston, Texas demonstrated.⁵¹

Poorer people and some racial and ethnic groups are among those who often confront higher exposure to air pollutants and who may experience greater responses to such pollution. Many studies have explored the differences in harm from air pollution to racial or ethnic groups, as well as people who are in a low socioeconomic position, have less education, or live nearer to major sources.⁵²

Poorer people, people of color, older people and disabled people will have a harder time responding to the threats, especially if electricity is lost or relocation or evacuation is required due to ever-more frequent and severe storms related to climate change.⁵³ Hurricane Katrina demonstrated that many people in these groups had difficulty evacuating and relocating after a major weather event.⁵⁴ Native American tribal communities may face threats to food supplies and difficulty relocating due to tribal land locations.⁵⁵

To protect health, the United States must reduce carbon pollution from existing power plants. The Clean Power Plan provides an excellent approach. The ACE proposed rule does not.

Given the overwhelming evidence of harm from climate change, the nation must reduce emissions from greenhouse gases from all sources, but particularly from electric utilities. Fossil fuel electricity generation is the largest stationary source of carbon dioxide and greenhouse gas emissions in the U.S.; as of 2016, power plants emitted 35 percent of the total U.S. carbon dioxide emissions.⁵⁶

The Clean Power Plan’s core flexibility encourages innovation and tailoring to reduce those emissions, including many tools that go beyond the property boundaries of a power plant. States need flexibility to use multiple tools and to innovate in their approaches to cut carbon. The Plan encourages innovation and the use of cleaner energy sources for electricity generation. The Plan encourages strategies to improve energy efficiency, which could decrease the need to burn fossil fuels. Many of our organizations, particularly those with state chapters, have worked to support the states’ adopting plans and systems that would provide the greatest reduction in carbon emissions to protect public health.

EPA has dismissed key provisions under the Clean Power Plan that would have offered greater benefits and less harm than the ACE proposed rule offers. Unlike the Clean Power Plan, the ACE proposed rule restricts the actions that can be taken to reduce emissions to minimal steps that can be taken within the boundaries of the power plant facility. That deprives the public of the flexibility and opportunities available through tools proven to reduce carbon emissions, including the use of clean energy sources like wind and solar as well as improved energy efficiency that reduces the demand for electricity in the first place.

As noted in the ACE proposal, EPA determines to use heat rate improvement solely as the “best system of emissions reduction” (BSER) for states to use under this proposed rule.⁵⁷ EPA references this decision to their flawed arguments made in the proposed repeal of the Clean Power Plan that only one of the three “building blocks” is legally acceptable as the basis used to calculate the target emissions rate. In the proposed repeal, EPA argued that Building Block 1, including carbon emission reductions at existing coal-fired power plants, is legally authorized, but that Building Blocks 2 (increased use of plants powered by lower emitting natural gas) and 3 (increased use of cleaner alternative energy sources like wind and solar) are not are not legally valid. EPA argued that these two would constitute illegal requirements that “regulation of the nation’s generation mix” and “[impose] greater emission reductions.”⁵⁸ EPA claimed that under their revised interpretation of the Clean Air Act, EPA cannot have a plan that incorporates the “types of measures that constitute the second and third ‘building block’ of the CPP.”⁵⁹ EPA also argued that, absent the other two components, “the first ‘building block’ cannot stand on its own in the form in which it was issued.”⁶⁰

Our groups weighed in on the flaws in this argument in our comments to the proposed repeal, and we repeat them here. This argument dismisses inappropriately the idea that the BSER could extend beyond “measures that can only be applied to or at the source.”⁶¹ In fact, no limitation in the statute supports EPA’s current basis here. EPA does have authority to set standards for existing plants based on the idea of substituting generation from cleaner options for generation from the dirtiest plants, to be implemented through a system of tradeable credits. That is because the electrical grid is a complex “system” that includes a network of sources and demand for electricity with varying costs; the costs drive the decision to use any electricity source. Contrary to the EPA’s argument in the ACE proposal, the Clean Air Act affords the opportunity and flexibility to each state to use all these tools to establish a plan for reducing carbon emissions from existing power plants in that state, either independently or in partnerships with other states—extending the “system” even to a broader, regional network that reflects the integrated electrical grid in most of the nation.

Of particular concern to our organizations is EPA's dismissal of the opportunity this broader system approach provides to protect public health. In the original Clean Power Plan, significant electricity generation would go to cleaner sources of power, reducing emissions not just of carbon, but of other air pollutants as well. Allowing plant owners to obtain allowances or credits from cleaner sources as an implementation strategy would not only reduce those emissions from dirtier, coal-fired sources, but would encourage the expanded use of cleaner sources like solar and wind going forward.

According to the U.S. Energy Information Administration, wind and solar provided more than 60 percent of all new utility-scale electricity generation capacity in 2016, setting new records for levels of wind- and solar-generated electricity.⁶² These sources add capacity within the complex networks that allow power plants to shift more and more electricity generation to sources that do not spew carbon and other harmful emissions into the air that our patients and the public breathe. Relying more on cleaner energy sources—while reducing the use of other more polluting sources—provides essential benefits to those most vulnerable to these emissions, especially those who live immediately downwind.

The electricity grid is a system that goes far beyond the property boundaries of any individual facility. This system operates as an integrated network now, with power generation dependent on the decisions of the utilities and end-users. EPA's complete reversal of its reliance in standard-setting on the reductions available from that system not only flies in the face of reality, it threatens the health of Americans across the nation.

Furthermore, EPA provides no benchmarks to define targets or standards in the ACE proposed rule.

This fails to follow the Clean Air Act's requirement that the Administrator must determine emission levels that are "achievable." With no target or standard, EPA cannot possibly assess whether the facilities even met the limited definition of BSER laid out in the ACE proposed rule. This failure builds into the proposal an easy out, allowing facilities to minimize their pollution reductions even further, or even do nothing, as no penalties exist for failure to comply

Adopting the ACE proposed rule would force Americans to suffer unnecessary risks to their health and lives that would be avoided under the Clean Power Plan.

Ultimately, the proposed ACE rule offers a likely future that is worse than taking no action, even according to EPA's own estimates. This is not a surprise, as assessments of similar proposals published during the review of the Clean Power Plan found that an approach that would limit required actions to those solely at a facility would create greater risk to human health and human life.

In 2014, researchers from Harvard University, Syracuse University, and Boston University evaluated alternative approaches for reducing carbon pollution from power plants, and showed that limits must be strong, flexible and enforceable to achieve the greatest health benefits for the American people.⁶³ That report, *Health Co-Benefits of Carbon Standards for Existing Power Plants*, showed that an approach targeting only actions on-site at a power plant had significant limitations and, in fact, would likely increase harmful emissions. By limiting actions to improving the efficiency of existing plants, a so-called

“inside the fence-line” approach did decrease the annual reductions in CO₂ emissions slightly (by 2.2 percent) from the 2020 reference case. However, the likelihood that the utilities would dispatch these more efficient plants more often resulted in an estimated annual 3 percent *increase* in sulfur dioxide emissions. This analysis estimated an increase in sulfur dioxide emissions projected to result in an increase in annual premature deaths and heart attacks.

EPA found similar threats to health in its own analysis. Under the proposal, EPA anticipates that utilities would run their old facilities even more frequently, because these facilities will have significantly improved energy efficiency. The emissions from these facilities will produce additional air pollutants recognized as threats to life and health. EPA estimates that, by 2030, running these facilities more frequently will result in up to an additional 1,400 premature deaths, as well as an additional 120,000 asthma attacks, compared to the base case of the CPP.⁶⁴ As EPA acknowledges, their assessments underestimate the risks, as they cannot account for the benefits of reduced mercury, SO₂ or NO₂.⁶⁵ Nor can they account for longer-term health risks, including increased lung cancer caused by particulate matter.

[EPA’s ACE proposal’s Regulatory Impact Analysis recognizes the lack of “thresholds” in the impacts of PM_{2.5}, but still includes assessment alternatives that use thresholds.](#)

In its Regulatory Impact Analysis (RIA) for the ACE proposal, EPA fortunately quantified the risks “associated with the full range of PM_{2.5} exposures experienced by the population,” adopting the conclusions reached in EPA’s 2009 and 2011 reviews of the particulate matter research and policy assessment.⁶⁶ This decision conforms with the findings of other major reviews by other major scientific organizations. The World Health Organization concluded in 2016 that “[s]mall particulate pollution have [sic] health impacts even at very low concentrations – indeed no threshold has been identified below which no damage to health is observed.”⁶⁷ The American Heart Association updated its Scientific Statement on Particulate Matter Air Pollution and Cardiovascular Disease in 2010 to state that the evidence supported measures to reduce PM because of the presence of no threshold of harm.⁶⁸

Citing the need to provide “transparency,” EPA nevertheless included models in the RIA that use selective thresholds, referencing the “uncertainty” recognized in the scientific reviews of the impacts at lower levels. However, these models did not reflect *uncertainty* about how much harm at lower levels; they instead both set specific *thresholds* of harm: one at the annual national ambient air quality standard for PM_{2.5}; and the other, at locations below PM_{2.5} levels considered in older studies.⁶⁹ EPA should shelve those models and continue to follow the “no threshold” assessments.

[The proposed changes to the New Source Review rule would remove life-saving protections and put public health at serious risk.](#)

The underlying goal of these proposals in their entirety appears to be to remove current New Source Review (NSR) requirements. Our organizations strongly oppose this part of the proposals as well and

urge EPA to exclude provisions to weaken NSR from any future actions. The NSR requirements provide critical safeguards to the health of the public and our patients that EPA must not erode.

Congress included NSR requirements in the Clean Air Act in clear recognition that utilities and other stationary sources may expand, move or otherwise alter their production; as they do so, their emissions at those facilities may increase. Those emissions must be limited to protect public health. Congress required that stationary sources seek permits, which require a review of the emissions and adoption of measures to reduce or offset the increases. Unfortunately, EPA's current proposal would undermine that principal through revisions to the process that would place millions of Americans at greater risk from air pollution.

The proposal would remove the annual limits on emissions from power plants, requiring the utilities to face limits only on their hourly emissions. EPA acknowledges that the plan would encourage existing plants to run more frequently, recognizing they could easily run many hours of increased emissions that meet the hourly standard while significantly increasing their annual emissions over the existing limits. EPA acknowledges that the intention of this proposal to revise the NSR is to allow such increases to no longer trigger NSR requirements.⁷⁰ The increased annual emissions would no longer be subject to NSR permitting requirements. This outcome is a long-sought goal of polluters – and comes despite the court having rejected EPA's similar, previous efforts to roll back these protections.⁷¹

EPA proposed this NSR-weakening action to assist its ACE proposal, but the real impact would be far broader. To reinterpret NSR as described, under any of the three options presented, would permanently weaken pollution protections from power plants undergoing any modification; this even includes actions that are completely separate from compliance with the ACE proposed rule. This NSR proposal marks a sweeping attempt to exempt increases in dangerous power plant emissions from cleanup, and it must be rejected.

[EPA should implement the Clean Power Plan, not the proposed ACE rule.](#)

The United States emits more carbon pollution than any other single nation except China⁷², and our electricity generating system is the highest emitting industrial source of such pollution. The U.S. needs to show greater leadership to fight climate change, as the threats to the lives and health of our citizens will not end with the current generation or even in the current century without profound action. The Clean Power Plan contains excellent tools to tackle those challenges. By comparison, the proposed ACE not only fails to provide an adequate response, the entire proposal would weaken key protections and would actually increase the premature deaths from these changes.

On behalf of our patients and the public, we urge EPA to reject the proposed Affordable Clean Energy rule and, instead, work to implement the Clean Power Plan.

Sincerely,

**Allergy & Asthma Network
Alliance of Nurses for Healthy
Environments
American College of Physicians
American Lung Association
American Public Health Association
Asthma and Allergy Foundation of
America**

**Association of Schools and Programs
of Public Health
Center for Climate Change and
Health
National Association of County and
City Health Officials
National WIC Association
Health Care Without Harm
Physicians for Social Responsibility**

¹ Hundreds of studies on the health effects of climate change have been published since EPA adopted the Clean Power Plan. This list includes just a sample: Watts N, Amann M, Ayeb-Karlsson S, Belesova K et al. 2018 The *Lancet* Countdown on health and climate change: from 25 years of inaction to a global transformation for public health. *Lancet* 391: 581-630; Ahdoot S, Pacjeco SE, and The Council on Environmental Health. 2015. Global Climate Change and Children’s Health. *Pediatrics* 138: e1-e17; Petlova EP, Vink JK, Horton RM, Gasparrini A, et al. 2017. Towards more comprehensive projections of urban heat-related mortality: estimates for New York City under multiple population, adaptation, and climate scenarios. *Environ Health Perspect.* 125: 47-55; National Research Council. 2015. *Modeling the Health Risks of Climate Change: Workshop Summary*. Washington, DC: The National Academies Press.; Short EE, Caminade C, and Thomas BN. Climate Change Contribution to the Emergence or Re-Emergence of Parasitic Diseases. 2017. *Infectious Diseases: Research and Treatment*. 10:1-7.

² IPCC, [Special Report on Global Warming of 1.5° C](#). 2018.

³ Quote from Panmao Zhai, Co-Chair of the IPCC Working Group from IPCC, [IPCC Press Release](#): Summary of Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments,” October 8, 2018. I.

⁴ IPCC, Frequently asked questions 3.1 p. 3-179.

⁵ Quote from Hans-Otto Pörtner, Co-Chair of IPCC Working Group II from IPCC, IPCC Press release.

⁶ Wuebbles DJ, Fahey DW, Hibbard KA, DeAngelo B, Doherty S, et al. 2017: Executive summary. In: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles DJ, Fahey DW, Hibbard KA, Dokken DJ, Stewart BC, and Maycock TK (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 12-34, doi: 10.7930/J0DJ5CTG.

⁷ U.S. Environmental Protection Agency. Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule. 40 CFR Part 60. 80 FR 64677. October 23, 2015.

⁸ Shea KM and the Committee on Environmental Health. 2007. Global Climate Change and Children’s Health. *Pediatrics*, 120; e1359; Adhoot, et al., 2015.

⁹ Crowley RA, for the Health and Public Policy Committee of the American College of Physicians. Climate Change and Health: A Position Paper of the American College of Physicians. *Ann Intern Med*. 2016; 164: 608-610.

¹⁰ National Wildlife Federation and Asthma and Allergy Foundation of America. *Extreme Allergies and Global Warming*. National Wildlife Foundation, 2010. Accessed at <http://www.aafa.org/media/Extreme-Allergies-Global-Warming-Report-2010.pdf>.

¹¹ American Public Health Association. *Climate Change: Mastering the Public Health Role. A Practical Guidebook*. April 2011. Accessed at <http://www.apha-environment.org/ClimateandHealth.aspx>.

¹² Pinkerton KE et al., An Official American Thoracic Society Workshop Report: Climate change and Human Health. *Proceedings American Thoracic Society* 2012; 9: 1: 3-8.

- ¹³ Rice MB, Thurston GD, Balmes JR, Pinkerton KE. [Climate change. A global threat to cardiopulmonary health.](#) *Am J Respir Crit Care Med.* 2014 Mar 1;189(5):512-9.
- ¹⁴ Barboza T. ["87 days of smog: Southern California just saw its longest streak of bad air in decades."](#) Los Angeles Times, September 21, 2018.
- ¹⁵ Bell ML, McDermott A, Zeger SL, Samet JM, Dominici F. Ozone and short-term mortality in 95 US urban communities, 1987-2000. *JAMA.* 2004; 292:2372-2378. Gryparis A, Forsberg B, Katsouyanni K, et al. Acute Effects of Ozone on Mortality from the "Air Pollution and Health: a European approach" project. *Am J Respir Crit Care Med.* 2004; 170: 1080-1087. Bell ML, Dominici F, and Samet JM. A Meta-Analysis of Time-Series Studies of Ozone and Mortality with Comparison to the National Morbidity, Mortality, and Air Pollution Study. *Epidemiology.* 2005; 16:436-445. Levy JI, Chermerynski SM, Sarnat JA. Ozone Exposure and Mortality: an empiric Bayes metaregression analysis. *Epidemiology.* 2005; 16:458-468. Ito K, De Leon SF, Lippmann M. Associations Between Ozone and Daily Mortality: analysis and meta-analysis. *Epidemiology.* 2005; 16:446-429.
- ¹⁶ U.S. Environmental Protection Agency. *Integrated Science Assessment of Ozone and Related Photochemical Oxidants (Final Report)*. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/076F, 2013.
- ¹⁷ Ventura County Air Pollution Control District Air Quality Twitter Feed, archived at <https://twitter.com/vcapcd>. Healey P. ["Smoke from Thomas Fire Prolongs Air Quality Decline,"](#) KNBC News Los Angeles, December 14, 2017.
- ¹⁸ USGCRP, 2017. Climate Science Special Report: Fourth National Climate Assessment, Volume1 [Wuebbles DJ, Fahey DW, Hibbard KA, Dokken DJ, Stewart BC and Maycock TK (eds.)] U.S. Global Change Research Program. Washington, DC.
- ¹⁹ Associated Press. Oklahoma Dust Storm Shuts Down Portion Of Interstate 35. Associated Press, October 18, 2012, Downloaded at <https://www.usatoday.com/story/weather/2012/10/19/dust-storm-shuts-down-interstate-in-northern-okla/1643851/>.
- ²⁰ USGRP, 2017.
- ²¹ Dominici F, McDermott A, Zeger SL, Samet JM. On the Use of Generalized Additive Models in Time-Series Studies of Air Pollution and Health. *Am J Epidemiol.* 2002; 156:193-203.
- ²² Hong Y-C, Lee J-T, Kim H, Ha E-H, Schwartz J, Christiani DC. Effects of Air Pollutants on Acute Stroke Mortality. *Environ Health Perspect.* 2002; 110:187-191.
- ²³ Tsai SS, Goggins WB, Chiu HF, Yang CY. Evidence for an Association Between Air Pollution and Daily Stroke Admissions in Kaohsiung, Taiwan. *Stroke.* 2003; 34: 2612-6.
- ²⁴ Wellenius GA, Schwartz J, Mittleman MA. Air Pollution and Hospital Admissions for Ischemic and Hemorrhagic Stroke Among Medicare Beneficiaries. *Stroke.* 2005; 36:2549-2553.
- ²⁵ Pope CA III, Dockery DW. Health Effects of Fine Particulate Air Pollution: Lines that Connect. *J Air Waste Manage Assoc.* 2006; 56:709-742
- ²⁶ D'Ippoliti D, Forastiere F, Ancona C, Agabity N, Fusco D, Michelozzi P, Perucci CA. Air Pollution and Myocardial Infarction in Rome: a case-crossover analysis. *Epidemiology.* 2003;14:528-535. Zanobetti A, Schwartz J. The Effect of Particulate Air Pollution on Emergency Admissions for Myocardial Infarction: a multicity case-crossover analysis. *Environ Health Perspect.* 2005; 113:978-982.
- ²⁷ Metzger KB, Tolbert PE, Klein M, Peel JL, Flanders WD, Todd K, Mulholland JA, Ryan PB, Frumkin H. Ambient Air Pollution and Cardiovascular Emergency Department Visits in Atlanta, Georgia, 1993-2000. *Epidemiology.* 2004; 15: 46-56.
- ²⁸ Tsai SS, et al., 2003.
- ²⁹ Wellenius GA, Schwartz J, and Mittleman MA. Particulate Air Pollution and Hospital Admissions for Congestive Heart Failure in Seven United States Cities. *Am J Cardiol.* 2006; 97 (3):404-408; Wellenius GA, Bateson TF, Mittleman MA, Schwartz J. Particulate Air Pollution and the Rate of Hospitalization for Congestive Heart Failure among Medicare Beneficiaries in Pittsburgh, Pennsylvania. *Am J Epidemiol.* 2005; 161:1030-1036.
- ³⁰ Stieb DM, Cen L, Eshoul M, Judek S. Ambient air pollution, birthweight and preterm birth: a systemic review and meta-analysis. *Environ Res.* 2012; 117: 100-111; Rogers JF, Dunlop AL. Air pollution and very low birthweight infants: a target population? *Pediatrics,* 2006; 118: 156-164; Huynh M, Woodruff TJ, Parke JD, Schoendorf KC. Relationships between air pollution and preterm birth in California. *Paediatr Perinat Epidemiol,* 2006; 20: 454-461.
- ³¹ Lin M, Chen Y, Burnett RT, Villeneuve PJ, Kerwski D. The Influence of Ambient Coarse Particulate Matter on Asthma Hospitalization in Children: case-crossover and time-series analyses. *Environ Health Perspect.* 2002; 110:575-581.
- ³² Norris G, YoungPong SN, Koenig JQ, Larson TV, Sheppard L, Stout JW. An Association Between Fine Particles and Asthma Emergency Department Visits for Children in Seattle. *Environ Health Perspect.* 1999;107:489-493.
- ³³ Tolbert PE, Mulholland JA, MacIntosh DD, Xu F, Daniels D, Devine OJ, Carlin BP, Klein M, Dorley J, Butler AJ, Nordenberg DF, Frumkin H, Ryan PB, White MC. Air Quality and Pediatric Emergency Room Visits for Asthma in Atlanta, Georgia. *Am J Epidemiol.* 2000; 151:798-810.
- ³⁴ Slaughter JC, Lumley T, Sheppard L, Koenig JQ, Shapiro, GG. Effects of Ambient Air Pollution on Symptom Severity and Medication Use in Children with Asthma. *Ann Allergy Asthma Immunol.* 2003; 91:346-353.
- ³⁵ Naeher LP, Brauer M, Lipsett M, Zelikoff JT, Simpson CD, Koenig JQ, Smith KR. 2007. Wood smoke Health Effects: A Review. *Inhalation Toxicology.* 19:67-106; Schreuder AB, Larson TV, Sheppard L, Claiborn CS. 2006. Ambient wood smoke and

associated respiratory emergency department visits in Spokane, Washington. *International Journal of Occupational and Environmental Health*. 12(2):147-53.

³⁶ U.S. EPA, *Assessment of the Impacts of Global Change on Regional U.S. Air Quality: A synthesis of climate change impact on ground-level ozone*. April 2009. EPA/600/R-07/094F.

³⁷ Lubert G, Knowlton K, Balbus J, Frumpkin H., et al. cha. 9: Human Health. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 2014; Li B, Sain S, Mearns LO, et al.. The impact of extreme heat on morbidity in Milwaukee, Wisconsin. *Climate Change*, 2012. 110: 959-976.

³⁸ Lubert et al., 2014

³⁹ Clasen-Kelly F. “[Florence damaged thousands of homes in the Carolinas: ‘This has been so stressful.’](#)” *The Charlotte Observer*, September 28, 2018. Ochner Matis J “‘No sense in leaving now’: Hurricane Michael recovery begins in Mexico Beach.” *Miami Herald*. October 21, 2018; Koh, Elizabeth. “They survived Michael but now lack healthcare basics: colostomy bags, oxygen, more.: *Miami Herald*. October 25, 2018.

⁴⁰ Echenique M. “[Exodus: The Post Hurricane Puerto Rican Diaspora, Mapped.](#)” CityLab, March 13, 2018. Alvarez, L. “[A Great Migration from Puerto Rico is set to Transform Orlando.](#)” *New York Times*, November 17, 2017.

⁴¹ Risser MD and Wehner MF. 2017. Attributable human-induced changes in the likelihood and magnitude of the observed extreme precipitation during Hurricane Harvey. *Geophysical Research Letters*. Pre-Publication. DOI: 10.1002/2017GL075888; van Oldenborgh GJ, van der Wiel K, Sebastian A, Singh R, et al. 2017. Attribution of extreme rainfall from Hurricane Harvey, August 2017. *Environmental Research Letters* 12:124009.

⁴² Lubert et al., 2014; APHA 2011.

⁴³ NWF and AAFA, 2010; Lubert et al., 2014; Ziska LH and Beggs PJ. Anthropogenic climate change and allergen exposure: The role of plant biology. *J Allergy Clin Immunol*. 2012; 129(1):27-32.

⁴⁴ Lubert et al., 2014

⁴⁵ USGCRP, 2017. p.11. U.S. Department of Agriculture. [2017 Secretarial Drought Designations](#), Accessed December 13, 2017. U.S. Department of Agriculture Economic Research Service. California Drought 2014: Farm and Food Impacts. September 12, 2014. <http://ers.usda.gov/topics/in-the-news/california-drought-2014-farm-and-food-impacts.aspx>

⁴⁶ Chapin, F. S., III, S. F. Trainor, P. Cochran, H. Huntington, C. Markon, M. McCammon, A. D. McGuire, and M. Serreze, 2014: Ch. 22: Alaska. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 514-536. doi:10.7930/J00Z7150

⁴⁷ Lubert et al., 2014; Clayton S, Manning CM, and Hodge C. Beyond storms & droughts: The psychological impacts of climate change. Washington, DC: American Psychological Association and ecoAmerica. 2014.

⁴⁸ Shea KM and the Committee on Environmental Health. Global Climate Change and Children’s Health. *Pediatrics*, 2007. ; 120; e1359; American Academy of Pediatrics Committee on Environmental Health, Ambient Air Pollution: health hazards to children. *Pediatrics*. 2004; 114: 1699-1707. Statement was reaffirmed in 2010.

⁴⁹ Zanobetti A, et al. Summer temperature variability and long-term survival among elderly people with chronic disease. *Proceedings of the National Academy of Sciences*, 2012. 109: 6608-6613.

⁵⁰ U.S. EPA. Integrated Science Assessment for Particulate Matter (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-08/139F, 2009; U.S. Environmental Protection Agency. *Integrated Science Assessment of Ozone and Related Photochemical Oxidants (Final Report)*. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/076F, 2013.

⁵¹ Thaller EI, Petronell SA, Hochman D, Howard S, Chhikara RS, Brooks EG. Moderate Increases in Ambient PM_{2.5} and Ozone Are Associated With Lung Function Decreases in Beach Lifeguards. *J Occp Environ Med*. 2008; 50: 202-211

⁵² Institute of Medicine. *Toward Environmental Justice: Research, Education, and Health Policy Needs*. Washington, DC: National Academy Press, 1999; O’Neill MS, Jerrett M, Kawachi I, Levy JI, Cohen AJ, Gouveia N, Wilkinson P, Fletcher T, Cifuentes L, Schwartz J et al. Health, Wealth, and Air Pollution: Advancing Theory and Methods. *Environ Health Perspect*. 2003; 111: 1861-1870; Finkelstein MM; Jerrett M; DeLuca P; Finkelstein N; Verma DK, Chapman K, Sears MR. Relation Between Income, Air Pollution And Mortality: A Cohort Study. *CMAJ*. 2003; 169: 397-402; Ostro B, Broadwin R, Green S, Feng W, Lipsett M. Fine Particulate Air Pollution and Mortality in Nine California Counties: Results from CALFINE. *Environ Health Perspect*. 2005; 114: 29-33; Zeka A, Zanobetti A, Schwartz J. Short term effects of particulate matter on cause specific mortality: effects of lags and modification by city characteristics. *Occup Environ Med*. 2006; 62: 718-725.

⁵³ Lubert et al., 2014; APHA, 2011..

⁵⁴ Lubert et al., 2014.

⁵⁵ Lubert et al., 2014; U.S. EPA, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, Proposed Rule, June 18, 2014, 79 FR 34949.

⁵⁶ U.S. Energy Information Administration. *Monthly Energy Review*, April 2017. Accessed at <https://www.eia.gov/tools/faqs/faq.php?id=75&t=11>. Ramseur JL. “U.S. Carbon Dioxide Emissions Trends and Projections: Role of the Clean Power Plan and Other Factors. Congressional Research Service Report. May 31, 2017. Accessed at <https://fas.org/sfp/crs/misc/R44451.pdf>

⁵⁷ 83 Federal Register 44750.

⁵⁸ 82 Federal Register 48041 and 48042.

⁵⁹ 82 Federal Register 48043.

⁶⁰ 82 Federal Register 48043.

⁶¹ 82 Federal Register 48037.

⁶² U.S. Energy Information Administration. July 6, 2017. [Monthly renewable electricity generation surpasses nuclear for the first time since 1984.](#)

⁶³ Driscoll C, Buonocore J, Levy J, Lambert K, et al. 2015 US power plant carbon standards and clean air and health co-benefits. *Nature Climate Change* 5: 525-540. Schwartz J, Buonocore J, Levy J, Driscoll C, Fallon Lambert K, and Reid S. Health Co-Benefits of Carbon Standard for existing Power Plants: Part 2 of the Co-Benefits of Carbon Standards Study. September 30, 2014. Harvard School of Public Health, Syracuse University, Boston University. Available at [Health Co-Benefits of Carbon Standards for Existing Power Plants.](#)

⁶⁴ U.S. Environmental Protection Agency. Regulatory Impact Analysis for the Proposed Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to emission Guideline Implementing Regulations; Revisions to New Source Review Program, August 2018. EPA-452/R-18-006, Table 4-7

⁶⁵ U.S. EPA, RIA, 2018. p. 4-25.

⁶⁶ U.S. Environmental Protection Agency. Integrated Science Assessment for Particulate Matter. U.S. Environmental Protection Agency. National Center for Environmental Assessment. Research Triangle Park. 2009; U.S. EPA. Policy Assessment for the Review of the Particulate Matter National Ambient Air Quality Standards. Research Triangle Park, NC. 2011.

⁶⁷ World Health Organization (WHO). 2016. [Ambient \(Outdoor\) Air Quality and Health. WHO Fact Sheet. Geneva, Switzerland. <http://www.who.int/mediacentre/factsheets/fs313/en/>](#)

⁶⁸ Brook RD, Rajagopalan S, Pope CA 3rd, Brook JR, et al; on behalf of the American Heart Association Council on Epidemiology and Prevention, Council on the Kidney in Cardiovascular Disease, and Council on Nutrition, Physical Activity and Metabolism. 2010. "Particulate matter air pollution and cardiovascular disease: an update to the scientific statement from the American Heart Association." *Circulation*. 121: 2331-2378.

⁶⁹ U.S. EPA. RIA, 2018, Table 6-13 and Table 6-14

⁷⁰ 83 Fed. Reg, 44775.

⁷¹ U.S. Court of Appeals, D.C. Circuit. No. 03-1380. State of New York et al. v. EPA, March 17, 2006.

⁷² Boden TA, Marland G, and Andres RJ. 2017. [National CO2 Emissions from Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring: 1751-2014](#), Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, doi 10.3334/CDIAC/00001_V2017