

American Academy of Pediatrics • American Heart Association
American Lung Association • American Public Health Association
American Thoracic Society • Center for Climate Change and Health
Health Care Climate Council • Health Care Without Harm
Public Health Institute • Trust for America's Health

December 1, 2014

Administrator Gina McCarthy
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units
EPA Docket ID No. EPA-HQ-OAR-2013-0602

Dear Administrator McCarthy:

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 proposed Carbon Pollution Emission Guidelines for Existing Stationary Sources, commonly referred to as the Clean Power Plan.

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 source, which are existing power plants. Our organizations support EPA's overall approach with the Clean Power Plan, but urge EPA to strengthen the final plan to provide greater protection to public health.

[Climate change poses serious threats to human health](#)

The changing climate threatens the health of Americans alive now and in future generations. Growing evidence over the past few years has demonstrated the multiple, profound risks that imperil the lives and health of millions. Consequently, the nation has a short window to act to reduce those threats.

On November 2nd, the Intergovernmental Panel on Climate Change issued its most recent policy assessment of current observations and analyses about the changing climate. The IPCC found:

“Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.”¹

This is only the latest report to make clear 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.

The *United States Third National Climate Assessment* issued in May 2014 provided the most recent summary of the research outlining these risks to the United States.² This review echoed reports

previously produced by several of our organizations: the American Academy of Pediatrics technical report in 2007 on “Global Climate Change and Children’s Health”³; Trust for America’s Health, *Health Problems Heat Up: Climate Change and the Public’s Health*, in October 2009⁴; the Asthma and Allergy Foundation of America’s *Extreme Allergies and Global Warming*, issued with the National Wildlife Foundation in 2010⁵; the American Public Health Association’s *Climate Change: Mastering the Public Health Role*, in April 2011⁶; and the American Thoracic Society’s workshop on Climate Change and Human Health published in 2012⁷. All these reviews arrived at similar conclusions, summarized below.

Ground-level ozone is likely to be worse in some locations. Ozone levels in the eastern states rose significantly during the hottest year on record in the United States in 2012.⁸ 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. Researchers repeatedly found that the risk of premature death increased with higher levels of ozone.⁹ 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.¹⁰

Wildfires and drought conditions give rise to smoke and dust storms spreading miles from their source. This past year has showcased the risks from wildfire smoke from blazes in the West. As of September, California had reported nearly 5,000 wildfires in 2014—1,000 *more than usual*—before fire season had even begun, as the *Los Angeles Times* noted.¹¹ In one example, particulate matter in the smoke from those fires covered Sacramento to Reno in a code purple particulate matter alert on September 21, 2014.¹² (Code Purple is the designation for “Very Unhealthy” air signifying that everyone may experience more serious health effects.)

Drought-driven dust storms also produce high levels of particulate matter. The impact of dust storms in recent years, such as one in Oklahoma in 2012 that shut down Interstate 35, demonstrate their power to threaten health in multiple ways.¹³

Even short-term exposure to such levels of particulate matter, short-term increases in particle pollution have been linked to premature death from respiratory and cardiovascular causes, including strokes^{14, 15, 16, 17}; increased mortality in infants and young children¹⁸; increased numbers of heart attacks, especially among the elderly and in people with heart conditions;¹⁹ increased hospitalization for cardiovascular disease, including strokes and congestive heart failure^{20, 21, 22}; increased hospitalization for asthma among children;^{23, 24, 25} and increased severity of asthma attacks in children.²⁶

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.²⁷

These examples show that these changes erect new hurdles to our ability to protect health from air pollution. As EPA noted 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.”²⁸

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.²⁹ Hotter temperatures can increase the risk of heat stroke and heat exhaustion and can increase the risk of hospitalization for cardiovascular and respiratory diseases.³⁰

Increased risk of dangerous hurricanes threatens not only damage and death from the wind, but disruption in communities that suffer the hurricanes. As Hurricane Katrina and Sandy showed, the disruption can last for years. Hospitals, clinics, medical care and public health services may be blocked from serving their patients and communities as resources are diverted to emergency response or too damaged to provide those services. Patients find themselves in emergency shelters or relocated to new homes far away from their previous medical caregivers.

According to the most recent assessments³¹, the nation has experienced increased heavy rainfall and flooding since 1991. Flooding causes premature deaths, often through drowning, but the aftermath of flooding expands the burden. Water damage leaves behind lingering risks including dampness and mold, chemicals and sewage spread through flood waters, and contaminated debris in flooded homes, schools, hospitals and other community facilities.³²

Allergens and risk of vector-borne diseases will increase. 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.³³ 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.³⁴

Food and water supplies face uncertain challenges. The ongoing drought in the West, particularly in California, exemplifies the risks to supplying adequate water and food supplies to the nation.³⁵ 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.³⁶

Stress will complicate response and 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.³⁷

Millions of Americans suffer greater vulnerability to these threats. Many people face greater risk or exposure, as documented in the large air pollution science assessments EPA has repeatedly completed. Children court special risks because their bodies are growing and because they are so active.³⁸ Older adults are more likely to die during high heat events.³⁹ 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.⁴⁰

Poorer people and some racial and ethnic groups are among those who often confront higher exposure to 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 and people who are in a low socioeconomic position, have less education, or live nearer to major sources.⁴¹

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.⁴² Hurricane Katrina demonstrated that many people in these groups had difficulty evacuating and relocating after a major

weather event.⁴³ Native American tribal communities may face threats to food supplies and difficulty relocating due to tribal land locations.⁴⁴

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.⁴⁵

To protect health, the United States needs to reduce carbon pollution from existing power plants.

Reducing carbon pollution essential step to reduce the burden of climate change, but the benefits go far outside the impact on the climate.

Lifesaving benefits to public health can begin immediately. In addition to reducing the longer-term risks from climate change, steps to cut carbon pollution will cut other toxic emissions as well. Estimated reductions include: 54,000 to 56,000 tons of PM_{2.5}; 424,000 to 471,000 tons of sulfur dioxide; and 407,000 to 428,000 tons of nitrogen dioxide. Those pollutants directly form particulate matter and ozone that cause widespread harm and premature death as described earlier.⁴⁶

Based on those reductions, EPA estimated that implementing the Clean Power Plan could avoid 2,700 to 6,600 premature deaths in 2030. In 2030, children would suffer 140,000 to 150,000 fewer asthma attacks. People with cardiovascular disease would have 340 to 3,300 fewer heart attacks. Hospital admissions for cardiovascular and respiratory conditions would drop, with 2,700 to 2,800 fewer admissions in 2030.⁴⁷

It is important to remember that the modeling actually minimizes the real-world benefits of these reductions. The EPA's use of established BenMAP modeling is appropriate to make these estimates, but the predictions focus on findings from certain studies looking at specific outcomes. The BenMAP model cannot estimate the impact on other, also demonstrated, benefits. For example, although the World Health Organization has determined that particulate matter causes lung cancer, science currently lacks appropriate modeling to estimate how many fewer cases of lung cancer would occur in 2030 with the reductions in particulate matter.⁴⁸

A separate, major study confirms that co-benefits from reducing carbon pollution are real, but that doing too little may prove harmful. Strong limits on carbon pollution from existing power plants could improve air quality and prevent an estimated 3,500 (780 to 6,100, 95% CI) premature deaths in 2020 along with other significant benefits to human health, according to an analysis released in September by researchers from Harvard University, Syracuse University, and Boston University. That report, *Health Co-Benefits of Carbon Standards for Existing Power Plants*, 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.⁴⁹

The study compared "business as usual" conditions with three alternatives for limiting carbon from power plants. Results showed that a strong, enforceable and flexible approach to reducing carbon pollution would reduce emissions of other harmful pollutants of sulfur dioxide and nitrogen oxides by about 775,000 tons each year. In addition to reducing premature deaths, the strongest options avoided 530 to 1500 hospital admissions for cardiovascular and respiratory diseases in 2020. As a result of lower emissions, all of the lower 48 U.S. states would experience cleaner air.⁵⁰

In another critical finding, this modeling showed that steps to do less had significant limitations and, in fact, probably harmful consequences. The model that limited actions to improving the efficiency of existing plants, sometimes called the “inside the fence” option, did decrease the annual in CO₂ emissions slightly (by 2.2 percent) from the 2020 reference case. However, the likelihood that these more efficient plants would be dispatched more often resulted in an estimated annual 3 percent *increase* in sulfur dioxide emissions. This estimated sulfur dioxide increase actually led the forecast for an increase in annual premature deaths and heart attacks, using this more limited approach. ⁵¹

[EPA’s overall Clean Power Plan provides excellent approach.](#)

The Clean Power Plan’s core flexibility encourages innovation and tailoring. We appreciate EPA’s commitment to allow the states to have flexibility to use multiple tools and to innovate in their approaches to cut carbon emissions. 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, intend to support the states adopting plans and systems that will provide the greatest reduction in carbon emissions to protect public health.

Requirements for permanent, enforceable, measurable, verifiable emission reductions are crucial. We also appreciate the EPA’s commitment to require that the states demonstrate “that each emissions standard is quantifiable, non-duplicative, permanent, verifiable, and enforceable” (79 FR 34838). States will have difficulty assessing, without verifiable measures, whether the actions they took have the expected impact. Unless compliance measures can be measured and verified, the potential exists for them to be ineffective, costing time and resources that could be spent in more effective measures.

The EPA must be clear that the final standards must be enforceable not just by EPA, but by citizens, including by nonprofits and non-governmental organizations as well as governments. To protect our members and patients, many of our organizations have had historically significant roles in ensuring that the Clean Air Act is defended and enforced. We support ensuring in the language that these measures are enforceable.

[Greater reduction in carbon emissions are needed.](#)

The United States emits more carbon pollution than any other single nation except China.⁵² We need 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 that challenge, but the goals are too limited to effectively respond to the problem.

The EPA should set more aggressive compliance dates without reducing targets. Our organizations agree with the EPA that states need time to phase in some measures. However, the EPA proposal offers an excessively long period for phase in compared to other similar major rules. We urge EPA to shorten the time for putting these measures in place, but *without* reducing the required reductions as the EPA suggested as an option. The President announced November 11th a commitment to reduce the nation’s net greenhouse gas emissions up to 28 percent below 2005 levels by 2025. To accomplish that goal, this plan must require more reductions from the existing electric sector.

All state plans must be complete by 2018, so the states would have twelve years to meet their goals in 2030. Five years would be reasonable and provide more time to implement than other large measures adopted by the EPA in the past, including the NOx SIP call and the Mercury and Air Toxics Standards. However, our organizations do not support setting weaker standards to accommodate that shorter timeframe. The EPA should revise the compliance schedule to ensure states start reducing emissions as soon as possible, and move the completion date to no later than 2025 without reducing the targets.

The targets need to recognize that states can and should do more to reduce carbon emissions. The EPA based the reductions on the agency's calculations of what each state could do. However, some states report that they are already doing more in some categories than EPA has proposed as a target. The EPA need to set standards that push states to do

Recognize that some alternative energy sources have serious impacts on health as well. Our organizations are concerned about expanding biomass as an acceptable alternative energy source because of the impacts to health from the emissions. Biomass combustion currently uses feed stocks that have proven harm to human health: wood products, agricultural residues or forest wastes, and potentially highly toxic feed stocks, such as construction and demolition waste. If biomass is combusted, state-of-the-art pollution controls must be required.

Conclusion

Our organizations have long recognized that climate change poses a major threat to the health of our patients and to the public. We are pleased that the Obama Administration has begun to take these critical steps to move the nation toward long-needed steps to reduce those threats. We appreciate the abundant opportunity to provide comment and weigh in on these issues.

Our organizations urge EPA to take advantage of this rare opportunity to provide the greater protection that is needed with an even stronger Clean Power Plan.

Sincerely,

James M. Perrin, MD, FAAP.
President

American Academy of Pediatrics

Sue Nelson
Vice President of Federal Advocacy

American Heart Association

Harold P. Wimmer
National President & CEO,
American Lung Association

Georges C. Benjamin, MD
Executive Director
American Public Health Association

Thomas W. Ferkol, MD
President

American Thoracic Society

Linda Rudolph, M.D., M.P.H.
Director

Center for Climate Change and Health

Eric Lerner
US Climate Director,
Health Care Without Harm

Mary A. Pittman DrPH
President & CEO
Public Health Institute

Jeff Levi, PhD
 Executive Director
 Trust for America's Health

Health Care Climate Council
 Representing 11 leading US Health Systems

¹ Intergovernmental Panel on Climate Change. *Climate Change 2014 Synthesis Report*. November 1, 2014. Accessed at http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_SPM.pdf.

² Melillo JM, Richmond TC, and Yohe GW, Eds. 2014. *Climate Change Impacts in the United States. The Third National Climate Assessment*. U.S. Global Change Research Program. Available at www.nca2014.globalchange.gov

³ Shea KM and the Committee on Environmental Health. Global Climate Change and Children's Health. *Pediatrics*, 2007. ; 120; e1359.

⁴ Trust for America's Health, *Health Problems Heat Up: Climate Change and the Public's Health*,

⁵ National Wildlife Federation and Asthma and Allergy Foundation of America. *Extreme Allergies and Global Warming*. National Wildlife Foundation, 2010. Accessed at http://www.nwf.org/pdf/Reports/NWF_AllergiesFinal.pdf.

⁶ 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>.

⁷ 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.

⁸ American Lung Association, *State of the Air: 2014*, <http://www.stateoftheair.org/2014/key-findings/>; U.S. Environmental Protection Agency Air Now. A look Back at Ozone 2013. Accessed at http://airnow.gov/index.cfm?action=airnow.news_item&newsitemid=104; Melillo JM, Richmond TC, and Yohe GW, Eds. *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, 2014. p.8.

⁹ 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.

¹⁰ 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.

¹¹ Rocha, Veronica. "1,000 more California wildfires than usual in 2014, and fire season just started," *Los Angeles Times*, September 23, 2014.

<http://www.latimes.com/local/lanow/la-me-ln-california-1000-wildfires-20140923-story.html>.

¹² Air Now Map for September 21, 2014. Accessed at <http://www.airnow.gov/index.cfm?action=airnow.mapsarchivedetail&domainid=2&mapdate=20140921&tab=1/>

¹³ Juozapavicius, Justin. Oklahoma Dust Storm Shuts Down Portion Of Interstate 35. Associated Press, October 18, 2012, Downloaded at

http://www.huffingtonpost.com/2012/10/18/oklahoma-dust-storm- n_1982501.html

¹⁴ 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.

¹⁵ 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.

¹⁶ 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.

¹⁷ Wellenius GA, Schwartz J, Mittleman MA. Air Pollution and Hospital Admissions for Ischemic and Hemorrhagic Stroke Among Medicare Beneficiaries. *Stroke*. 2005; 36:2549-2553.

¹⁸ Pope CA III, Dockery DW. Health Effects of Fine Particulate Air Pollution: Lines that Connect. *J Air Waste Manage Assoc*. 2006; 56:709-742

¹⁹ 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.

²⁰ 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.

²¹ Tsai SS, et al., 2003.

²² 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.

²³ 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.

²⁴ 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.

²⁵ 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.

²⁶ 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.

²⁷ 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.

²⁸ 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.

²⁹ 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.

³⁰ Lubert et al., 2014

³¹ Walsh, J., D. Wuebbles, K. Hayhoe, J. Kossin, K. Kunkel, G. Stephens, P. Thorne, R. Vose, M. Wehner, J. Willis, D. Anderson, S. Doney, R. Feely, P. Hennon, V. Kharin, T. Knutson, F. Landerer, T. Lenton, J. Kennedy, and R. Somerville, 2014: Ch. 2: Our Changing Climate. *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, 19-67. doi:10.7930/J0KW5CXT.

³² Lubert et al., 2014; APHA 2011.

³³ 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.

³⁴ Lubert et al., 2014

³⁵ 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>

³⁶ 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

³⁷ 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.

³⁸ 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.

³⁹ 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.

⁴⁰ 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.

⁴¹ 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.

⁴² Luber et al., 2014; APHA, 2011..

⁴³ Luber et al., 2014.

⁴⁴ Luber 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.

⁴⁵ 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

⁴⁶ U.S. EPA. Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants (RIA). June 2014. EPA-542/R-14-002.

⁴⁷ U.S. EPA. RIA, 2014.

⁴⁸ World Health Organization International Agency for Research on Cancer. *IARC Monograph on the Evaluation of Carcinogenic Risks to Humans.* Volume 109, Outdoor Air Pollution. Lyon: IARC (in Press).

⁴⁹ 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.](#)

⁵⁰ Schwartz J, Buonocore J, et al., 2014.

⁵¹ Schwartz J, Buonocore J, et al., 2014.

⁵² U.S. Department of Energy Carbon Dioxide Analysis Center. Fossil Fuel Emissions by Nation, 2010. Updated August 22, 2014. Available at http://cdiac.ornl.gov/trends/emis/tre_coun.html#