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Attention: Docket ID No. EPA-HQ-OAR-2017-0355, Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units

Joint Comments of Environmental and Public Health Organizations Regarding the Proposed Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units

Comments Specific to Climate Change

Center for Biological Diversity; Clean Air Council; Clean Air Task Force; Earthjustice; Environmental Defense Fund; Environmental Law and Policy Center; Minnesota Center for Environmental Advocacy; National Parks Conservation Association; Natural Resources Defense Council; Sierra Club; and the Union of Concerned Scientists ("Organizations") ("Joint Commenters") hereby submit these comments on EPA's Proposed Rulemaking Regarding the Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 82 Fed. Reg. 48,035 (Oct. 16, 2017) (the "Repeal Proposal" or "Proposal"). These comments address the topic of climate change as it relates to the Repeal Proposal. The Joint Commenters will also submit additional joint comments to this docket on other subjects relating to the Proposal, and some of the organizations joining these comments will submit additional comments separately.

I. INTRODUCTION

These comments discuss the voluminous scientific evidence published since the CPP's promulgation that overwhelmingly reinforces EPA's already compelling record from 2015, and amplifies EPA's conclusion that greenhouse gases ("GHG") (including carbon dioxide ("CO_2")) endanger public health and welfare by driving increasingly dangerous climate change. In particular, we discuss the evidence demonstrating the following climate change-driven harms, some of which are already upon us:

- An unrelenting rise in atmospheric temperatures, rendering increasingly large geographic areas less habitable;
- The increasing frequency and severity of some extreme weather events, and the scientific advances attributing shifts in extremes to anthropogenic GHG emissions;
- Steadily rising ocean temperatures, sea level rise and the dire effects of ocean acidification;
- Increasing harm to human health and welfare, including current and future deaths and severe illness that disproportionately affect the elderly, children and disadvantaged communities;
- Harm to biodiversity, ecosystem services, and public lands;
- Severe harm to the U.S. economy with damages exceeding hundreds of billions of dollars annually and rising over time;
- The clear and present danger of climate change to our national security; and
- The United States' inability to remain within its shrinking carbon budget absent immediate action to greatly reduce power plant GHG emissions.

Climate change and the overwhelming evidence of the devastation it causes underscore that EPA must fulfill its legal mandate to reduce power plant CO_2 emissions, and that implementation of the CPP is both critical and urgent.

At the outset, it is important to emphasize that EPA's egregious failure to address the critical threat of climate change in the Repeal Proposal reflects not merely bad public policy, but is *unlawful*. Under the Administrative Procedure Act, courts must set aside agency actions that are "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law."[1] The Supreme Court has explained that agency actions are arbitrary and capricious "if the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise."[2]

This principle holds true whenever an agency seeks to change or reverse a previous policy. The agency must "show that there are good reasons for the new policy" and provide "a reasoned explanation . . . for disregarding facts and circumstances that underlay or were engendered by the prior policy."[3] Where an agency action rests on factual findings (or, as here, factual *assumptions* and conclusory assertions) that contradict its earlier findings, the agency must provide "a more detailed justification than would suffice for a new policy."[4] A failure to do

[1] 42 U.S.C. § 7607(d)(9)(A).
[2] *Motor Vehicle Mfrs. Ass'n of the United States v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983).
[3] *Encino Motorcars, LLC v. Navarro*, 136 S. Ct. 2117, 2126 (2016) (quoting *Fed. Commc'ns Comm'n v. Fox Television Stations, Inc*, 556 U.S. 502, 515-16 (2009).
[4] *Fox Television Stations*, 556 U.S. at 515.

so renders the action arbitrary and capricious. "An agency cannot simply disregard contrary or inconvenient factual determinations that it made in the past."[5]

EPA's Repeal Proposal runs directly afoul of these bedrock administrative law principles. In 2009, EPA found—based on an "ocean of evidence"[6]—that anthropogenic GHGs are driving climate change that endangers public health and welfare;[7] the D.C. Circuit upheld that finding in its entirety against industry challenges,[8] and the Supreme Court refused to review the holding.[9] In the CPP, EPA reaffirmed the 2009 endangerment finding's conclusions.[10] As we discuss below, since 2009, the literature on climate change and evidence of both future and *current* climate impacts has become even more clear, specific and undeniable, further buttressing the rigor of the endangerment finding and the urgency of the Clean Air Act's legal mandate that EPA secure maximum feasible reductions in CO_2 emissions from existing power plants.

Remarkably, despite the overwhelming record evidence demonstrating that climate disruption is becoming ever more severe, the Repeal Proposal all but ignores the entire subject of climate change. It does not even attempt to explain how repealing the CPP and narrowing the scope of the "best system of emission reduction" to preclude the highly efficacious and cost-effective measures in building blocks 2 and 3 could be squared with the CPP's record and the additional evidence discussed herein. The Repeal Proposal also ignores the scores of studies and reports published since the 2009 endangerment finding and the CPP's promulgation. This fundamental, appalling failure renders the Repeal Proposal unlawful, arbitrary and capricious.

These comments provide an overview of peer-reviewed, climate change related scientific studies released since 2015. The depth and breadth of their findings emphasize the legal deficiency of the Repeal Proposal's complete failure to grapple with climate change and the ever increasing havoc it wreaks. All references cited in these comments are submitted separately to this docket in the "Joint Appendix of Environmental and Public Health Organizations and States Regarding the Proposed Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generation Units (submitted in person by John Bullock on April 20, 2018)."

II. EPA'S LEGAL OBLIGATION TO LIMIT CO_2 POLLUTION FROM EXISTING POWER PLANTS HAS BEEN REAFFIRMED AND ITS IMPORTANCE AMPLIFIED BY RECENT SCIENTIFIC AND ECONOMIC STUDIES

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[5] *Id*. at 537 (Kennedy, J., concurring).
[6] *Coal. for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102, 123 (D.C. Cir. 2012), *rev'd in part on other grounds sub nom. Util. Air Regulatory Grp. v. EPA*, 134 S. Ct. 2427 (2014).
[7] Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009).
[8] *Coal. for Responsible Regulation*, 684 F.3d at 116-26.
[9] The Supreme Court denied the petitions for certiorari that sought to challenge the D.C. Circuit's ruling upholding the Endangerment Finding. *Virginia v. EPA*, 571 U.S. 951 (2013), and *Pac. Legal Found. v. EPA*, 571 U.S. 951 (2013).
[10] Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,662, at 64,682-88 (Oct. 23, 2015) [hereinafter Clean Power Plan].

EPA's 2015 CPP rulemaking stands in stark contrast to the Repeal Proposal's flimsy-to-non-existent record. The 2015 CPP rulemaking is based on a comprehensive record of peer-reviewed evidence demonstrating the causes and effects of climate change and the need to promptly reduce GHGs generated by fossil fuel-burning power plants.

In the 2015 CPP rulemaking, EPA reaffirmed its 2009 endangerment finding that anthropogenic GHGs emissions jeopardize public health and public welfare.[11] It discussed[12] the key findings of major peer-reviewed studies of climate change issued after 2009 by the U.S. Global Change Research Program ("USGCRP"),[13] the Intergovernmental Panel on Climate Change ("IPCC"),[14] and the National Research Council ("NRC").[15] EPA found that these more

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[11] *Id.*

[12] *Id.* at 64,683-88.

[13] USGCRP, Climate Change Impacts in the United States: The Third National Climate Assessment, Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe (eds.) (2014), http://nca2014.globalchange.gov/. Congress created the USGCRP in 1990 to serve as "a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change," Global Change Research Act of 1990, Pub. L. No. 101-606, 15 U.S.C. § 2931(b), and urged EPA and other policymakers to use its work to formulate "a coordinated national policy on global climate change," *id.* § 2938(b)(1)-(2). *See also* 15 U.S.C. § 2934(d)(3) (directing the USGCRP to "combine and interpret data from various sources to produce information readily usable by policymakers attempting to formulate effective strategies for preventing, mitigating, and adapting to the effects of global change").

[14] IPCC, Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects, Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.) (2014), www.ipcc.ch/report/ar5/wg2/. IPCC, Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects, Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.) (2014), www.ipcc.ch/report/ar5/wg2/. IPCC, Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change, Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.) (2012), https://wg1.ipcc.ch/srex/.

[15] NRC, Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean, Committee on the Development of an Integrated Science Strategy for Ocean Acidification Monitoring, Research, and Impacts Assessment (2010), www.nap.edu/catalog/12904/ocean-acidification-a-national-strategy-to-meet-the-challenges-of. NRC, Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia, Committee on Stabilization Targets for Atmospheric Greenhouse Gas Concentrations (2011), www.nap.edu/catalog/12877/climate-stabilization-targets-emissions-concentrations-and-impacts-over-decades-to. NRC, National Security Implications of Climate Change for U.S. Naval Forces, Committee on National Security Implications of Climate Change for U.S. Naval Forces (2011), www.nap.edu/catalog/12914/national-security-implications-of-climate-change-for-us-naval-forces. NRC, Understanding Earth's Deep Past: Lessons for Our Climate Future, Committee on the Importance of Deep-Time Geologic Records for Understanding Climate Change Impacts (2011), www.nap.edu/catalog/13111/understanding-earths-deep-past-lessons-for-our-climate-future. NRC, Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future, Committee on Sea Level Rise in California, Oregon, and Washington (2012), www.nap.edu/catalog/13389/sea-level-rise-for-the-coasts-of-california-oregon-and-washington. NRC, Climate and Social Stress: Implications for Security Analysis, Committee on Assessing the Impacts of Climate Change on Social and Political Stresses (2013), www.nap.edu/catalog/14682/climate-and-social-stress-implications-for-security-analysis. NRC, Abrupt Impacts of Climate Change: Anticipating Surprises, Committee on Understanding and Monitoring Abrupt Climate Change and Its Impacts (2013), www.nap.edu/catalog/18373/abrupt-impacts-of-climate-change-anticipating-surprises.

recent studies "improve understanding of the climate system and strengthen the case that GHGs endanger public health and welfare both for current and future generations."[16]

EPA explained, for example, that "[s]ince the 2009 Endangerment Finding, the USGCRP [Third National Climate Assessment], and multiple NRC assessments have projected future rates of sea level rise that are 40 percent larger to more than twice as large as the previous estimates from [2007] due in part to improved understanding of the future rate of melt of the Antarctic and Greenland Ice sheets."[17] It found that "[t]he most recent assessments now have greater confidence that climate change will influence production of pollen that exacerbates asthma and other allergic respiratory diseases such as allergic rhinitis, as well as effects on conjunctivitis and dermatitis."[18] And the agency noted that, as of the date of the preamble's publication in 2015, "2014 was the warmest year globally in the modern global surface temperature record, going back to 1880; this now means 19 of the 20 warmest years have occurred in the past 20 years, and except for 1998, the ten warmest years on record have occurred since 2002."[19] EPA's Regulatory Impact Assessment ("RIA") for the CPP references the evidence in the 2009 endangerment finding and in major studies issued since then and discusses climate change's general impacts and effects on vulnerable communities such as indigenous populations, communities of color, children, the poor, and the elderly.[20]

In contrast to the CPP record, the Repeal Proposal's preamble and RIA do not mention any of the evidence supporting either the 2009 endangerment findings or the CPP's determinations on climate harm, and include virtually *no* discussion of climate change at all apart from acknowledging that climate benefits would be sacrificed by repealing the CPP.[21] Worse still, as we discuss in other comments to the docket, EPA has deeply discounted these foregone public health and environmental benefits by using flawed economics and faulty science.[22] EPA's failure fully to account for and properly measure the ever increasing harm necessarily resulting from the CPP repeal is unlawful, arbitrary, and capricious.

Below, we discuss new evidence presented in scientific studies published after the CPP's promulgation that demonstrates the escalating harms of climate change on the environment and human health and welfare.

[16] 80 Fed. Reg. at 64,683.
[17] *Id.* at 64,684.
[18] *Id.* at 64,683.
[19] *Id.* at 64,686.
[20] EPA, Regulatory Impact Analysis for the Clean Power Plan Final Rule, at 1-2 to -3, 4-2 to -3, 7-16 to -20 (Aug. 2015) [hereinafter Clean Power Plan RIA].
[21] *See generally* Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units (Proposed Rule), 82 Fed. Reg. 48,035 (Oct. 16, 2017) [hereinafter Repeal Proposal]; EPA, Regulatory Impact Analysis for the Review of the Clean Power Plan: Proposal (Oct. 2017) [hereinafter Repeal Proposal RIA].
[22] *See* Joint Comments of Environmental and Public Health Organizations Regarding the "Proposed Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units," 82 Fed. Reg. 48,035 (Oct. 16, 2017), Comments Specific to the "*Regulatory Impact Analysis for the Review of the Clean Power Plan: Proposal*" (October 2017).

a. Scientific Studies Overwhelmingly Demonstrate that Climate Change Is Already Causing Immediate, Devastating Impacts on Communities Across the Country and Will Lead to Further Catastrophic Damages.

i. Greenhouse gas emissions are making the Earth's climate hotter and more extreme.

According to the Fourth National Climate Assessment published in November 2017 by the USGCRP — (a federal program in which the EPA is a constituent agency, along with NASA, NOAA, the National Science Foundation, and others) —"there is no convincing alternative explanation" for the observed warming of the climate over the last century other than human activities.[23] Global CO_2 emissions from fossil fuel use more than tripled from the 1960s to the period from 2007 to 2016,[24] and accounted for approximately 82 percent of the increase in the Earth's energy balance (i.e., "heat trapping") over the past decade.[25]

2017 was the second warmest year ever recorded for the U.S., with only 2016 warmer than last year.[26] 2017's extreme weather and climate disasters killed hundreds of Americans and cumulatively cost $306 billion, making 2017 by far the costliest year on record in terms of climate harms.[27] According to one recent study, "*this sequence of record-breaking temperatures had a negligible (<0.03%) likelihood of occurrence in the absence of anthropogenic warming*."[28] Another new study found that "the 2016 record global warmth was only possible due to substantial centennial-scale anthropogenic warming."[29]

Annual average temperatures in the United States have increased by 1.8°F (1.0°C) since 1901,[30] and the number of heat waves (defined as six-day periods with a maximum temperature above the 90th percentile for 1961 through 1990) has increased since the 1960s.[31] In the last two decades, more than two daily heat records were broken in the U.S. for every daily cold record.[32]

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[23] USGCRP, Climate Science Special Report: Fourth National Climate Assessment, Vol. I, Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.) (2017), https://science2017.globalchange.gov/downloads/CSSR2017_FullReport.pdf at 10 [hereinafter USGCRP 2017].
[24] Le Quéré, C. *et al*., Global Carbon Budget 2017, 10 EARTH SYST. SCI. DATA DISCUSS. 405, 423-24 (2018), https://doi.org/10.5194/essd-2017-123.
[25] World Meteorological Organization ["WMO"] and Global Atmosphere Watch 2017, The State of Greenhouse Gases in the Atmosphere Based on Global Observations through 2016, 13 WMO GREENHOUSE GAS BULLETIN, 3 (2017), https://library.wmo.int/opac/doc_num.php?explnum_id=4022.
[26] National Aeronautics and Space Administration [NASA], Long-term warming trend continued in 2017: NASA, NOAA, Release 18-003 (Jan. 18, 2018), https://www.nasa.gov/press-release/long-term-warming-trend-continued-in-2017-nasa-noaa.
[27] NOAA National Centers for Environmental Information [NCEI], U.S. Billion-Dollar Weather and Climate Disasters (2018), https://www.ncdc.noaa.gov/billions/.
[28] Mann, M.E., *et al*., Record Temperature Streak Bears Anthropogenic Fingerprint, 44 GEOPHYS. RES. LETT. 7936 (2017) (emphasis added), http://onlinelibrary.wiley.com/doi/10.1002/2017GL074056/abstract.
[29] Knutson, T.R., *et al*., CMIP5 Model-based Assessment of Anthropogenic Influence on Record Global Warmth During 2016, 99 BAMS S11 (2017), https://www.ametsoc.org/ams/index.cfm/publications/bulletin-of-the-american-meteorological-society-bams/explaining-extreme-events-from-a-climate-perspective.
[30] USGCRP 2017 at 13.
[31] *Id.* at 191.
[32] *Id.* at 192.

By comparison, in a stable climate, the ratio of high- to low-temperature records would be approximately 1:1.[33]

To put their findings in context, scientific reports often express the extent of scientific understanding of key findings by means of clearly defined metrics expressing the degree of confidence in those findings. [34] Where the following discussion uses these metrics, it presents them in italics.

The U.S. is expected with *high confidence* to warm by an additional 2.5°F, on average, over the next few decades.[35] Daily highs are likewise projected with *very high confidence* to increase.[36] Under business as usual, the hottest days of the year could be at least 5°F (2.8°C) warmer in most areas by mid-century and 10°F (5.5°C) by late this century.[37] The urban heat island effect — which is expected with *high confidence* to strengthen as urban areas expand and become denser — will amplify climate-related warming even beyond those dangerous increases.[38]

Heavy precipitation has likewise become more frequent and intense in most regions of the U.S. since 1901 (*high confidence*),[39] even as average annual precipitation has decreased in some regions (*medium confidence*).[40] This finding is consistent with the scientific understanding that more water vapor is available to fuel extreme rain and snowstorms as the world warms (*medium confidence*).[41] Recent studies of Hurricane Harvey[42] and the 2016 flood in south

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[33] Meehl, G.A., *et al.*, US Daily Temperature Records Past, Present, and Future, 113 PNAS 13977 (2016), www.pnas.org/content/113/49/13977.
[34] The USGCRP communicates the extent of scientific understanding of its key findings with two metrics: "confidence", and "likelihood." Confidence is defined as "the validity of a finding based on the type, amount, quality, strength, and consistency of evidence (such as mechanistic understanding, theory, data, models, and expert judgment); the skill, range, and consistency of model projections; and the degree of agreement within the body of literature." The scale is *very high confidence* (strong evidence and high consensus), *high confidence* (moderate evidence and medium consensus), *medium confidence* (suggestive evidence and competing schools of thought), and *low confidence* (inconclusive evidence and disagreement or lack of expert opinion). Likelihood is defined as the "probability of an effect or impact occurring," and is "based on measures of uncertainty expressed probabilistically … e.g., resulting from evaluating statistical analyses of observations or model results or on expert judgment." The scale is *virtually certain* (99 to 100 percent likelihood), *extremely likely* (95 to 100 percent likelihood), *very likely* (90 to 100 percent likelihood), *likely* (66 to 100 percent likelihood), *about as likely as not* (33 to 66 percent likelihood), unlikely (0 to 33 percent likelihood), *very unlikely* (0 to 10 percent likelihood), *extremely unlikely* (0 to 5 percent likelihood), and *exceptionally unlikely* (0 to 1 percent likelihood). USGCRP 2017 at 6, 7.
[35] *Id.* at 11.
[36] *Id.* at 185.
[37] *Id.* at 197.
[38] *Id.* at 17.
[39] *Id.* at 20.
[40] *Id.* at 207.
[41] *Id.* at 214.
[42] Emanuel, K., Assessing the Present and Future Probability of Hurricane Harvey's Rainfall 2017, 114 PNAS EARLY EDITION (2017), www.pnas.org/cgi/doi/10.1073/pnas.1716222114; Risser, M.D. and M.F. Wehner, Attributable Human-induced Changes in the Likelihood and Magnitude of the Observed Extreme Precipitation During Hurricane Harvey, 44 GEOPHYS. RES. LETT. 12,457 (2017), doi: 10.1002/2017GL075888; van Oldenborgh, G.J. *et al.*, Attribution of Extreme Rainfall from Hurricane Harvey, 12 ENVIRON. RES. LETT. 124009 (2017), https://doi.org/10.1088/1748-9326/aa9ef2.

Louisiana[43] concluded that climate warming made the record rainfall totals of both disasters more likely and intense. Under continued high GHG emissions, most U.S. regions are projected to experience two to three times more extreme precipitation events by the end of the century than they do now.[44] Rainfall during hurricanes making landfall in the eastern U.S. could also increase by 8 to 17 percent over the next century, compared to 1980-to-2006 levels.[45]

Human activities have contributed to the upward trend in North Atlantic hurricane activity since the 1970s (*medium confidence*).[46] Climate change is projected to increase hurricane intensity, making hurricanes more destructive by fueling higher wind speeds and more rainfall.[47] One recent study suggests the average intensity of Atlantic hurricanes will increase 1.8 to 4.2 percent by the 2080s, compared to a 1981 to 2000 baseline.[48] Adding to increases in hurricane intensity, there is *very high confidence* that sea level rise will make coastal floods more frequent and severe during storms.[49] For example, relative sea levels in New York City increased 19.7 inches (50 centimeters) between 1800 and 2000.[50] The rise in sea levels also increased the height of flooding during Hurricane Sandy from 7.5 to 9.2 feet (2.3 to 2.8 meters).[51] Combined with sea level rise, more intense hurricanes could result in a median increase in storm surge from 25 to 47 percent along the U.S. Gulf and Florida coasts.[52]

Global average sea level rose by seven to eight inches since 1900, and the rate of sea level rise is accelerating.[53] Global sea level is likely to rise by 1.0 to 4.3 feet by the end of the century relative to the year 2000, with sea level rise of 8.2 feet possible.[54] Sea level rise is already making flooding more likely. Sea level rise has contributed to a 5- to 10-fold increase in minor tidal floods along the U.S. coast since the 1960s (*very high confidence*). Those tidal floods are expected with *very high confidence* to become more frequent, deeper, and wider in extent as sea levels continue to rise.[55]

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[43] van der Wiel, K., *et al*., Rapid Attribution of the August 2016 Flood-inducing Extreme Precipitation in South Louisiana to Climate Change, 21 HYDROL. EARTH SYST. SCI. 897 (2017), www.hydrol-earth-syst-sci.net/21/897/2017/.
[44] USGCRP 2017 at 218.
[45] Wright, D.B., *et al*., Regional climate model projections of rainfall from U.S. landfalling tropical cyclones, 45 CLIM. DYN. 3365 (2015), https://link.springer.com/article/10.1007%2Fs00382-015-2544-y.
[46] USGCRP 2017 at 257.
[47] *Id.*
[48] Balaguru, K., *et al*., Future Hurricane Storm Surge Risk for the U.S. Gulf and Florida Coasts Based on Projections of Thermodynamic Potential Intensity, 138 CLIMATIC CHANGE 99 (2016), https://link.springer.com/article/10.1007%2Fs10584-016-1728-8.
[49] USGCRP 2017 at 27.
[50] Lin, N., *et al*., Hurricane Sandy's Flood Frequency Increasing from Year 1800 to 2100, 113 PNAS 12071 (2016), www.pnas.org/content/113/43/12071. We converted the return period in Lin *et al.* 2016 to probabilities with National Weather Service, Flood Return Period Calculator, www.weather.gov/epz/wxcalc_floodperiod (accessed Nov. 28, 2017).
[51] Lin *et al*. 2016.
[52] Balaguru *et al.* 2016.
[53] USGCRP 2017 at 339.
[54] *Id.* at 25-26, 333, 343.
[55] *Id.* at 333.

Climate warming also has exacerbated recent historic droughts and western U.S. wildfires by reducing soil moisture and contributing to earlier spring melt and reduced water storage in snowpack (*high confidence*).[56] In the continental western U.S., human-caused climate change accounted for more than half of observed increases in forest fuel aridity from 1979 to 2015.[57] Drying of forest fuels has helped increase the number of large fires (*high confidence*) and has contributed to a doubling in fire area since the early 1980s.[58] The risk of severe wildfire in Alaska has likely increased by 33 to 50 percent because of climate change.[59] One model suggests that anthropogenic climate change may have quintupled the risk of extreme vapor pressure deficit (a measure of atmospheric moisture) in the western U.S. and Canada in 2016, increasing the risk of wildfire.[60]

In addition to warming Earth's climate, CO_2 emissions have made the surface of global oceans about 30 percent more acidic over the last 150 years.[61] There is *medium confidence* that the current rate of acidification is higher than at any time in at least the last 66 million years.[62] Under continued high emissions of CO_2, surface acidity is expected with *high confidence* to increase by another 100 to 150 percent by the end of the century.[63]

Finally, the Fourth National Climate Assessment concluded with *very high confidence* that large-scale shifts in the climate system, also known as tipping points, and the compound effects of simultaneous extreme climate events have the potential to create unanticipated, and potentially abrupt and irreversible, "surprises" that become more likely as warming increases.[64] The disastrous effects of compound extreme events are, in fact, already occurring, such as during Hurricane Sandy when sea level rise, abnormally high ocean temperatures, and high tides combined to intensify the storm and associated storm surge, and an atmospheric pressure field over Greenland steered the hurricane inland to an "exceptionally high-exposure location."[65] The crossing of tipping points could result in climate states wholly outside human experience and result in severe physical and socioeconomic impacts.[66] For example, increased rainfall and meltwater from Arctic glaciers have the potential to slow a major ocean current called the Atlantic meridional overturning circulation ("AMOC"). If the AMOC slows or collapses, the northeastern U.S. will see a dramatic increase in regional sea levels of as much as 1.6 feet (0.5

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[56] *Id.* at 231.
[57] *Id.* at 243.
[58] *Id.* at 243.
[59] *Id.* at 244.
[60] Tett, S.F.B., *et al*., Anthropogenic Forcings and Associated Changes in Fires Risk in Western North America and Australia During 2015/16, 99 BAMS S60 (2018), https://www.ametsoc.org/ams/index.cfm/publications/bulletin-of-the-american-meteorological-society-bams/explaining-extreme-events-from-a-climate-perspective/.
[61] USGCRP 2017 at 372. Acidification is causing many parts of the ocean to be undersaturated with the calcium carbonate minerals that are the building blocks for the skeletons and shells of many marine organisms, which impairs these organisms' ability to produce and maintain their skeletons and shells. *See* Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, What Is Ocean Acidification, *available at*: https://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F.
[62] USGCRP 2017 at 364.
[63] *Id.*
[64] *Id.* at 411-23.
[65] *Id.* at 416.
[66] *Id.* at 411.

meters).[67] Another potential tipping point in the Arctic is the release of carbon (either as CO_2 or as methane) from thawing permafrost, which has the potential to "drive continued warming even if human-caused emissions stopped altogether."[68] In 2016, record high temperatures were set at most permafrost monitoring sites in the Arctic.[69]

ii. Climate change threatens human health.

Anthropogenic climate change is already affecting public health, and will pose even more severe threats without action to greatly limit GHGs.[70] EPA recognized and accounted for these threats in the CPP rulemaking. For instance, in the CPP preamble, EPA explained that "climate change is expected to increase ozone pollution over broad areas of the U.S., especially on the highest ozone days and in the largest metropolitan areas with the worst ozone problems, and thereby increase the risk of morbidity and mortality."[71] It further summarized findings that "climate change, in addition to chronic stresses such as extreme poverty, is negatively affecting indigenous peoples' health in the U.S. through impacts such as reduced access to traditional foods, decreased water quality, and increasing exposure to health and safety hazards."[72] The agency also explained that "children's unique physiology and developing bodies contribute to making them particularly vulnerable to climate change. Impacts on children are expected from heat waves, air pollution, infectious and waterborne illnesses, and mental health effects resulting from extreme weather events."[73] Evidence gathered since the CPP's promulgation shows the threats to human health have only multiplied and become more severe. Administrator Pruitt, however, does not discuss any specific health-related impacts from climate change anywhere in the Repeal Proposal or its RIA, in contravention of his duty to "examine all relevant factors and record evidence, and to articulate a reasoned explanation for [his] decision."[74]

Heat is the most direct health threat from climate change,[75] particularly for older adults and young children, outdoor workers, low-income communities, communities of color, and people with chronic illnesses (*very high confidence*).[76] A recent review found evidence for 27 different ways in which extreme heat leads to deadly organ failure, including (but not limited to) such pathologies as ischemia (inadequate blood supply), heat cytotoxicity, and inflammatory

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[67] *Id.* at 418.
[68] *Id.* at 419.
[69] Romanovsky, V.E., *et al*., Terrestrial Permafrost, in Arctic Report Card 2017, J. Richter-Menge *et al*., eds. (2017), http://www.arctic.noaa.gov/report-card.
[70] USGCRP, The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska (eds.) (2016), https://health2016.globalchange.gov/ at 26 [hereinafter USGCRP 2016].
[71] Clean Power Plan, 80 Fed. Reg. at 64,682.
[72] *Id.* at 64,683.
[73] *Id.*
[74] *Am. Wild Horse Pres. Campaign v. Perdue*, 873 F.3d 914, 923 (D.C. Cir. 2017) (citing *State Farm*, 463 U.S. at 52).
[75] USGCRP 2016 at 30.
[76] *Id.* at 44.

response—conditions that can affect the brain, heart, intestines, kidneys, and liver.[77] It is very likely that the United States will see thousands to tens of thousands more premature heat-related deaths in the summer under business as usual. The increase in heat deaths will likely be larger than a concomitant decrease in cold-related deaths.[78]

Extreme heat can exacerbate or cause a range of illnesses such as respiratory diseases or pre-term births that often require expensive emergency treatment.[79] More than 73,000 U.S. patients hospitalized for heat-related illnesses in the U.S. from 2001 to 2010 had a median stay of two days, at a median cost of nearly $9,000 per stay. Costs were highest among adults over 65 years, African-Americans, Asians/Pacific Islanders, and women.[80]

By one estimate, nearly one-third of the world's population is currently exposed to a deadly combination of heat and humidity for at least 20 days a year; without deep cuts in global GHG emissions, that percentage is projected to rise to nearly three-quarters of the world's population by the end of the century.[81] Although air conditioning and other response measures can help limit heat-related deaths and illnesses, future increases in heat could "recurrently 'imprison people' indoors and may turn infrastructure failures (e.g., power outages) into catastrophic events."[82] Florida got a taste of that future after Hurricane Irma knocked out electricity at a nursing home and at least 14 residents tragically lost their lives due to heat.[83]

Climate change also is likely to worsen air quality by accelerating the formation of ground-level ozone pollution (*high confidence*), increasing fine particle pollution and ozone pollution from wildfires (*high confidence*), and making pollen and mold allergy seasons longer and more severe (*high confidence*).[84]

For example, there is consistent evidence that wildfire smoke exacerbates existing respiratory health problems, including asthma and chronic obstructive pulmonary disease. Growing evidence also suggests that wildfire smoke exposure is associated with increased risk of respiratory infections.[85] The severe wildfires in summer and fall of 2017 sent people across Washington and California to triage centers, hospitals, and doctors' offices with breathing problems.[86] Communities already suffer a considerable economic burden from the illnesses and

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[77] Mora, C., *et al*., Twenty-Seven Ways a Heat Wave Can Kill You: Deadly Heat in the Era of Climate Change, 10 CIRC. CARDIOVASC. QUAL. OUTCOME e004233 (2017), http://circoutcomes.ahajournals.org/content/10/11/e004233 [hereinafter Mora *et al*. Circ. Cardiovasc. Qual. Outcome].
[78] USGCRP 2016 at 44.
[79] *Id.* at 50.
[80] Schmeltz, M.T., *et al*., Economic Burden of Hospitalizations for Heat-Related Illnesses in the United States, 2001–2010, 13 INT. J. ENVIRON. RES. PUBLIC HEALTH 894 (2016), www.mdpi.com/1660-4601/13/9/894.
[81] Mora, C. *et al*., Global Risk of Deadly Heat, 7 NATURE CLIMATE CHANGE 501 (2017), www.nature.com/articles/nclimate3322.
[82] Mora *et al*., Circ. Cardiovasc. Qual. Outcome.
[83] Nedelman, M., *Husband and Wife Among 14 Dead After Florida Nursing Home Lost A/C*, CNN (Oct. 9, 2017), www.cnn.com/2017/10/09/health/florida-irma-nursing-home-deaths-wife/index.html.
[84] USGCRP 2016 at 70.
[85] Reid, C.E., *et al*., Critical Review of Health Impacts of Wildfire Smoke Exposure, 124 ENVIRON. HEALTH PERSPECT. 1334 (2016), http://dx.doi.org/10.1289/ehp.1409277.
[86] Upton, J., Breathing Fire, Climate Central (Nov. 7, 2017), www.climatecentral.org/news/breathing-fire-california-air-quality-smoke-waves-21754.

deaths related to wildfire smoke. A study that modeled wildfire smoke exposures over the continental U.S. from 2008 to 2012 found that health costs from short-term smoke exposures totaled $63 billion in net present value over the study period, and $450 billion for long-term exposure effects.[87]

Young children, older adults, those active outdoors, and people with asthma are among the populations most vulnerable to climate-related increases in air pollution.[88] Estimates show that the annual costs that asthma imposes on U.S. states range from $60.7 million (Wyoming) to $3.4 billion (California) due to medical expenditures, and $4.4 million (Wyoming) to $345 million (California) from missed work and school days.[89]

The USGCRP has also determined with *high confidence* that climate change will alter the geographical extent and seasonal timing of tick- and mosquito-borne diseases like Lyme disease and West Nile Virus.[90] The two species of ticks capable of spreading Lyme disease — the most common vector-borne illness in the U.S.[91] — have already expanded to new regions of the U.S. partly because of rising temperatures.[92] In 2015, *Ixodes scapularis* and *I. pacificus* were found in more than 49 percent of counties in the continental U.S., a nearly 45 percent increase since 1998.[93] Globally, climate change has also increased the capacity of mosquitoes to generate new infections of dengue fever, and the number of dengue cases each year has doubled every decade since 1990.[94]

Rising temperatures, more extreme rainfall, and coastal storm surges are expected with *medium confidence* to increase the risk of water-[95] and food-borne illnesses.[96] For example, vibriosis is an infection contracted through contaminated shellfish or seawater that can lead to diarrhea, skin infections, or even death.[97] The bacteria that cause vibriosis grow more quickly in

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[87] Fann N., *et al*., The Health Impacts and Economic Value of Wildland Fire Episodes in the U.S.: 2008–2012, 610-611 SCI. TOTAL ENVIRON. 802 (2018), www.sciencedirect.com/science/article/pii/S0048969717320223?via%3Dihub.

[88] USGCRP 2016 at 70; *see also* EPA, Health Effects of Ozone Pollution, https://www.epa.gov/ozone-pollution/health-effects-ozone-pollution (last visited Apr. 20, 2018).

[89] Nurmagambetov, T., *et al*., State-level Medical and Absenteeism Cost of Asthma in the United States, 54 J. ASTHMA 357 (2017), www.tandfonline.com/doi/full/10.1080/02770903.2016.1218013.

[90] USGCRP 2016 at 130.

[91] Schwartz, A.M., *et al*., Surveillance for Lyme Disease — United States, 2008-2015, 66 MMWR 1 (2017), www.cdc.gov/mmwr/volumes/66/ss/ss6622a1.htm.

[92] Eisen, R.J., *et al*., Tick-Borne Zoonoses in the United States: Persistent and Emerging Threats to Human Health, ILAR Journal (2017), https://academic.oup.com/ilarjournal/advance-article/doi/10.1093/ilar/ilx005/3078806.

[93] Eisen, R.J., County-Scale Distribution of *Ixodes scapularis* and *Ixodes pacificus* (Acari: Ixodidae) in the Continental United States, 53 J. MED. ENTOMOL. 349 (2016), https://academic.oup.com/jme/article/53/2/349/2459744.

[94] Watts, N., et al., The *Lancet* Countdown on Health and Climate Change: From 25 Years of Inaction to a Global Transformation for Public Health, Lancet Online First (2017) (Watts et al., 2017), www.thelancet.com/journals/lancet/article/PIIS0140-6736(17)32464-9/fulltext.

[95] USGCRP 2016 at 158.

[96] *Id*. at 190.

[97] Centers for Disease Control and Prevention, *Vibrio* Species Causing Vibriosis, www.cdc.gov/vibrio/index.html (accessed Nov. 28, 2017).

warmer waters and are restricted to warmer months of the year along much of the eastern U.S. coast.[98] Reported cases of vibriosis have tripled in the U.S. since 1996.[99]

In addition, climate-related disasters like inland flooding, wildfires, and hurricanes are associated with myriad health threats including injuries, skin infections, mental health conditions, and deaths (*high confidence*).[100]

iii. Climate change and ocean acidification harm biodiversity, ecosystem services, and public lands.

Species can respond to climate change in three ways: they can cope through temporary changes or evolutionary adaptation, relocate to new habitats, or go extinct.[101] Both geographic shifts and extinctions will have dramatic consequences for biodiversity and the ecosystem functions on which humans depend.[102] EPA recognized and accounted for these threats in the CPP rulemaking. For example, in the CPP preamble, the agency discussed the NRC's *Abrupt Impacts* report, which "analyzed the threat of rapid state changes in ecosystems and species extinctions as examples of an irreversible impact that is expected to be exacerbated by climate change. Species at most risk include those whose migration potential is limited, whether because they live on mountaintops or fragmented habitats with barriers to movement, or because climatic conditions are changing more rapidly than the species can move or adapt."[103] EPA also described *Abrupt Impacts'* analysis of "similarities between the projections for future acidification and warming and the extinction at the end of the Permian[,] which resulted in the loss of an estimated 90 percent of known species."[104] Similarly, EPA cited the NRC's *Understanding Earth's Deep Past* assessment, which "notes [that] four of the five major coral reef crises of the past 500 million years were caused by acidification and warming that followed GHG increases of similar magnitude to the emissions increases expected over the next hundred years."[105] In the CPP Repeal Proposal, on the other hand, the agency has offered no discussion or analysis of such impacts, even though the evidence of these harms has become even more alarming.

Because attempting to shift its range is often a species' first response to new environmental pressures, climate change is already "impelling a universal redistribution of life on Earth."[106] In fact, many species have experienced local extinctions at the warm edge of their range as they have shifted to cooler latitudes or elevations. A recent review of 976 plant and animal species around the world found that 47 percent have experienced climate-related local

[98] Muhling, B.A., *et al*., Projections of the Future Occurrence, Distribution, and Seasonality of Three Vibrio Species in the Chesapeake Bay Under a High-Emission Climate Change Scenario, 1 GeoHealth 278 (2017), doi:10.1002/2017GH000089.
[99] USGCRP 2016 at 164.
[100] USGCRP 2016 at 100.
[101] Wiens, J.J., Climate-Related Local Extinctions are Already Widespread Among Plant and Animal Species, 14 PLOS Biology e2001104 (2016), http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2001104 [hereinafter Wiens 2016].
[102] Pecl, G.T., *et al*., Biodiversity Redistribution Under Climate Change: Impacts on Ecosystems and Human Well-Being, 355 Science eaai9214 (2017) [hereinafter Pecl *et al*. 2017]. Wiens 2016.
[103] Clean Power Plan, 80 Fed. Reg. at 64,684.
[104] *Id.* at 64,685.
[105] *Id.*
[106] Pecl *et al*. 2017.

extinctions, with the highest extinction rates occurring in tropical species, animals, and freshwater habitats.[107] The redistribution of species has been linked to reduced terrestrial productivity, alterations in ecological networks in marine habitats, and the development of toxic algal blooms.[108]

Many species will be unable to move quickly enough—or to move at all—due to geographical barriers such as oceans or mountains, characteristics of their life history, a lack of suitable new habitat, or the rapid pace of local changes in climate.[109] For instance, high temperatures, ocean acidification, and non-climate stressors are already causing significant losses of shallow coral reefs in the U.S.[110] Under continued high emissions of GHGs, shallow coral cover in Hawaii is expected to decline from 38 percent in 2010 to 11 percent in 2050.[111] Shallow corals are projected to nearly disappear from south Florida by the late 2030s and from Puerto Rico by the 2070s.[112] In the Arctic's Eastern Bering Sea, reduced ocean productivity linked to higher temperatures is expected to reduce catches of walleye pollock, one of the largest fisheries in the world. At the same time, however, continuing winter sea ice cover may limit the ability of pollock to shift northward to cooler, more productive waters.[113] By one estimate, 4.3°C of additional global warming caused by continued high levels of GHGs could lead to the extinction of 1 in 6 of the world's species.[114]

Both population declines and species extinctions can disrupt the structure and function of ecological networks, which in turn can harm or eliminate ecosystem functions such as pollination.[115] Oyster reefs, for example, provide a wide array of ecosystem services including food production, water filtration, shoreline stabilization, and cultural heritage. Ocean acidification threatens those services by stunting oyster growth, causing developmental abnormalities in larval oysters, and increasing mortality.[116] One recent review of nearly 120 scientific studies found negative effects of climate change on ecosystem services in 59 percent of the analyses. Regulating services (e.g., biological control of pests) and cultural services (e.g., tourism) were strongly harmed by climate change.[117] Another meta-analysis reported that climate

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[107] Wiens 2016.
[108] Pecl *et al*. 2017.
[109] Wiens 2016. Vázquez, D.P., *et al*., Ecological and Evolutionary Impacts of Changing Climatic Variability, 92 BIOL. REV. 22 (2017), http://onlinelibrary.wiley.com/doi/10.1111/brv.12216/abstract.
[110] USEPA, Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment, EPA 430-R-17-001, at 171 (2017), https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=335095.
[111] *Id.* at 172.
[112] *Id.* at 173.
[113] Zador, S., *et al*., Groundfish Fisheries in the Eastern Bering Sea, in Arctic Report Card 2017, J. Richter-Menge, *et al*., eds., 2017, http://www.arctic.noaa.gov/report-card.
[114] Urban, M.C., Accelerating Extinction Risk from Climate Change, 348 SCIENCE 571 (2015), http://science.sciencemag.org/content/sci/348/6234/571.full.pdf.
[115] Young, H.S., *et al*., Patterns, Causes, and Consequences of Anthropocene Defaunation, 47 ANNU. REV. ECOL. EVOL. SYS. 333 (2016), www.annualreviews.org/doi/10.1146/annurev-ecolsys-112414-054142.
[116] Lemasson, A.J., *et al*., Linking the Biological Impacts of Ocean Acidification on Oysters to Changes in Ecosystem Services: A Review, 492 J. EXP. MAR. BIOL. ECOL. 49 (2017), www.sciencedirect.com/science/article/pii/S002209811730059X?via%3Dihub.
[117] Runting, R.K., *et al*., Incorporating climate change into ecosystem service assessments and decisions: a review, 23 Glob. Change Biol. 28 (2016), doi: 10.1111/gcb.13457.

change is already adversely affecting 82 percent of 94 key ecological processes that form the foundation of healthy ecosystems.[118]

America's national parks are bellwethers for many of these changes. In 2014, the National Park Service published a study that examined the extent to which 289 parks are experiencing extreme climate changes when compared to the historical records from 1901 to 2012.[119] Results show that our national parks are overwhelmingly at the extreme warm end of the historical temperatures. For example, rising sea levels in Florida's Everglades National Park threaten the mangrove ecosystem that filters saltwater, thereby preserving freshwater wetlands.[120] Rising temperatures and drought in New Mexico's Bandelier National Monument have driven bark beetles to higher elevations, causing high mortality rates to the Piñon pines. Rising temperatures in Yellowstone National Park are also killing whitebark pine trees; loss of whitebark pine translates to reduced grizzly bear survival in Yellowstone because grizzlies rely heavily on whitebark pine seeds as a critical source of nutrition.[121] Warmer temperatures in Great Smoky Mountains National Park could increase ozone levels, further damaging critical tree and plant species.[122] Our national parks are living emblems of our nation's heritage, and they warrant regulations and policies that promote ecosystem resilience, enhance restoration and conservation of the system's essential resources, and preserve America's natural and cultural legacy.

iv. Climate change hurts the U.S. economy.

Climate- and weather-related disasters are already harming the U.S. economy. There have been 219 such disasters since 1980 that cost the country at least $1 billion each, for a total cost of more than $1.5 trillion.[123] In 2017, there were 16 separate weather and climate disaster events in the U.S. with damages exceeding $1 billion each, totaling $306 billion—a new U.S. record.[124]

In the CPP rulemaking, EPA provided both a macro-level discussion of the economic consequences of climate change as well as a discussion of many specific phenomena that will have negative economic repercussions. With regard to the former, the agency discussed in detail its use of the Interagency Working Group's social cost of carbon metric to quantify the negative economic impacts resulting from each marginal ton of CO_2 pollution and the corresponding economic benefits resulting from each marginal ton of emission *reduction*. With regard to the latter, the agency catalogued many specific impacts from climate change that will have negative

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118 Scheffers, B.R., *et al.*, The broad footprint of climate change from genes to biomes to people, 354 SCIENCE 719 (2016), http://science.sciencemag.org/content/354/6313/aaf7671.
119 Monahan WB and NA Fisichelli, Climate Exposure of US National Parks in a New Era of Change, 9 PLoS ONE 7: e101302. doi:10.1371/journal.pone.0101302 (2014).
120 National Park Service, Climate Change – Everglades National Park, https://www.nps.gov/ever/learn/nature/cceffectssalineglades.htm (accessed Dec. 29, 2017).
121 National Park Service, Climate Change in National Parks, https://www.nature.nps.gov/climatechange/docs/NPSClimateChangeBrochure.pdf (accessed Dec. 29, 2017).
122 Andrew Bingham and Ellen Porter, Ozone effects on two ecosystem services at Great Smoky Mountains National Park, National Parks Service (2015), https://www.nps.gov/articles/parkscience_32_1_71-79_bingham_porter_3825.htm.
123 NOAA National Centers for Environmental Information (NCEI), U.S. Billion-Dollar Weather and Climate Disasters (2018), https://www.ncdc.noaa.gov/billions/.
124 *Id.*

economic consequences, such as storm and flooding damage to property and loss of land,[125] increases in peak electricity demand,[126] threats to energy, transportation, and water resource infrastructure,[127] net adverse impacts on U.S. food production, agriculture and forest productivity,[128] environmental constraints on trade,[129] increased levels of poverty among underserved populations such as indigenous Arctic communities, who rely heavily on environmental resources that are particularly vulnerable to climate change,[130] negative impacts on livelihoods,[131] inflated food prices and food insecurity,[132] increased needs for humanitarian aid,[133] threats to fisheries,[134] reduced crop yields,[135] depressed tourism,[136] and freshwater shortages.[137]

In stark contrast, the CPP Repeal Proposal and RIA discuss *no* specific economic impacts from climate change, nor do they assess how the proposed repeal may exacerbate these impacts. This is a basic violation of EPA's duties to "consider [the] important aspect[s] of the problem"[138] in front of it and to "examine all relevant factors and record evidence."[139] The Repeal Proposal and RIA's only discussion of climate change's economic consequences is an unlawfully skewed and fundamentally erroneous assessment that drastically undervalues the estimated net climate benefits that would be lost if the repeal were finalized.[140] For example, as discussed in detail in other comments submitted by the Joint Commenters and others to the docket, Administrator Pruitt has used a deeply flawed "interim domestic social cost of carbon" metric to quantify these net climate benefits.[141] Recent data, however, demonstrate that the economic harm attributable to climate change is *at least* as devastating as the CPP determined it to be. According to a 2017 technical assessment by EPA's Climate Change Impacts and Risk Analysis ("CIRA") project, climate change will cost the U.S. economy hundreds of billions of dollars each year under conservative estimates.[142] Projected damages are significantly larger under a high-emissions scenario. Damages also increase over time, but not necessarily gradually; abrupt changes in

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[125] 80 Fed. Reg. at 64,683.
[126] *Id.*
[127] *Id.*
[128] *Id.*
[129] *Id.*
[130] *Id.*
[131] *Id.* at 64,685.
[132] *Id.*
[133] *Id.*
[134] *Id.*
[135] *Id.* at 64,686.
[136] *Id.* at 64,688.
[137] *Id.*
[138] *State Farm*, 463 U.S. at 43.
[139] *Perdue*, 873 F.3d at 923.
[140] 82 Fed. Reg. at 48,043-4; *see also* Repeal Proposal RIA at 42-46, 89, 122-23, App. C.
[141] Repeal Proposal RIA at 42-46.
[142] USEPA, Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A Technical Report for the Fourth National Climate Assessment, 209-10 (2017), *available at* https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=335095 [hereinafter USEPA 2017].

climate may likewise lead to abrupt increases in economic harm.[143] Some of the major climate-related economic impacts examined include:

- **Labor losses ($160 billion per year).** Changes in extreme temperature, particularly heat, are expected to reduce the number of suitable working hours in the contiguous U.S. by 1.9 billion hours in 2090.[144] Globally, heat has already reduced outdoor labor capacity in rural areas by approximately 5.3 percent from 2000 to 2016.[145] In 2013, 16,320 U.S. workers missed work because of heat-related illnesses.[146]

- **Heat-related deaths ($140 billion per year).** By 2090, 49 U.S. cities will see an estimated 9,300 additional premature deaths due to heat.[147]

- **Damage to coastal property ($120 billion per year).** The combination of sea level rise and storm surge will put energy infrastructure and residential, commercial, industrial, and government properties at significant risk by 2090. This damage estimate is extremely conservative, as it does not include transportation or telecommunication infrastructure or ecological resources.[148] The credit-rating agency Moody's already incorporates the severe financial risks of sea level rise and hurricane damage in its assessment of state and local credit-worthiness.[149]

- **Damage to roads ($20 billion per year).** Extreme heat, heavy rain and flooding, and changes in freeze-thaw cycles are expected to significantly increase costs for road maintenance, repair, and replacement by 2090.[150] A more recent analysis suggests that costs associated with heat alone could exceed $35 billion per year in 2070.[151]

- **Need for increased electricity generation ($9.2 billion per year).** Electricity demand is expected to increase in every region of the U.S. as temperatures rise, increasing the costs of power generation in 2090.[152]

Other national-scale studies have confirmed the CIRA report's finding that unmitigated climate change will have extremely damaging economic impacts on the United States. For example, a September 2017 report by the Government Accountability Office highlighted a 2014 study by the Rhodium Group, entitled the "American Climate Prospectus," that assessed the impacts of climate change on coastal property, health, agriculture, the energy sector, labor

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[143] *Id.* at 3, 4.
[144] *Id.* at 54.
[145] Watts *et al.*, 2017 at 581.
[146] Office of Compliance, Fast Facts — Heat Stress: Don't Let the Heat Get You Down, www.compliance.gov/sites/default/files/Heat%20Stress%202016%20Fast%20Fact_1.pdf (accessed Nov. 29, 2017).
[147] USEPA 2017 at 48.
[148] *Id.* at 113.
[149] Moody's Investors Services, Evaluating the Impact of Climate Change on US State and Local Issuers (2017).
[150] USEPA 2017 at 86.
[151] Underwood, S.B., *et al.*, Increased Costs to US Pavement Infrastructure from Future Temperature Rise, 7 NATURE CLIMATE CHANGE 704 (2017), www.nature.com/articles/nclimate3390.
[152] USEPA 2017 at 120.

productivity, and crime.[153] According to the Rhodium study, the likely combined impacts of climate change would reduce United States gross domestic product by 1 to 3 percent each year by the end of this century. The *annual* health-related impacts alone could reach as high as $161 billion over the 2040-2059 period and surpass $500 billion by the 2080-2099 period. Losses in labor productivity could be as high as $150 billion per year by 2080-2099, and storm-related losses and sea level rise could cause an additional $190 billion per year in property damage from 2080-2099.[154]

v. Climate change threatens national security.

Military and intelligence leaders have long recognized the national security threats of climate change.[155] As the Department of Defense concluded in a 2015 report to Congress,[156] "[g]lobal climate change will have wide-ranging implications for U.S. national security interests over the foreseeable future because it will aggravate existing problems—such as poverty, social tensions, environmental degradation, ineffectual leadership, and weak political institutions—that threaten domestic stability in a number of countries."

In fact, the Department of Defense "sees climate change as a present security threat, not strictly a long-term risk. [The Department is] already observing the impacts of climate change in shocks and stressors to vulnerable nations and communities, including in the United States, and in the Arctic, Middle East, Africa, Asia, and South America."[157] For instance, the number of dangerously hot days – known as "black flag days" – has increased at a Department facility in the Middle East, requiring the suspension of "non-mission essential physical training and strenuous exercise."[158] Flooding associated with high tides has also damaged national security infrastructure at multiple locations, including antenna facilities at a missile testing range in the Pacific.[159]

Extreme heat, storms and floods, sea level rise, and loss of natural resources will damage military installations, disrupt supply chains, imperil the safety of personnel, hamper training and readiness, increase the need for deployments in high risk areas of the world, and dramatically

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[153] *See* U.S. Government Accountability Office, Climate Change: Information on Potential Economic Effects Could Help Guide Federal Efforts to Reduce Fiscal Exposure (Sept. 2017), https://www.gao.gov/assets/690/687466.pdf [hereinafter USGAO 2017].
[154] *Id.* at 20 (citing Rhodium Group LLC, *American Climate Prospectus: Economic Risks in the United States* (Oct. 2014)).
[155] The Climate and Security Advisory Group, A Responsibility to Prepare (2018), https://climateandsecurity.files.wordpress.com/2018/02/climate-and-security-advisory-group_a-responsibility-to-prepare_2018_02.pdf.
[156] U.S. Department of Defense, National Security Implications of Climate-Related Risks and a Changing Climate, 3 (2015), http://archive.defense.gov/pubs/150724-congressional-report-on-national-implications-of-climate-change.pdf?source=govdelivery [hereinafter USDOD 2015].
[157] *Id.* at 14.
[158] U.S. Government Accountability Office, Climate Change Adaptation: DOD Needs to Better Incorporate Adaptation into Planning and Collaboration at Overseas Installations, 19 (2017), https://www.gao.gov/assets/690/688323.pdf.
[159] *Id.*

increase operating costs—exposing America's service personnel and citizens at home and abroad to needless risks and preventable harms.[160]

In sum, the record at the time the CPP was promulgated and studies and reports issued thereafter present overwhelming evidence that climate change is already wreaking havoc on public health and the environment, that the American economy is suffering damages measured in hundreds of billions of dollars annually, and that these trends are accelerating and could lead to catastrophic effects unless action is taken *now* to reverse course. Administrator Pruitt's failure to engage with these facts in the CPP Repeal Proposal is arbitrary and capricious. The agency must withdraw that document and implement and strengthen the CPP.

b. To Conduct a Proper Assessment of the Repeal Proposal and its Effect on Climate Change and the Public Health and Welfare Impacts, EPA Must Take Account of the Entire CPP Docket, the Climate Science Cited in the Reconsideration Denial, and the Climate Change Studies Referenced in These Comments.

Administrator Pruitt has not combined the Repeal Proposal's docket with the dockets for the CPP or the reconsideration denial. Full consideration of all of these materials in the repeal proceeding (as well as climate change-related studies published before any final rule is promulgated) is crucial to any reasoned explanation of a potential repeal of the CPP. For this reason, we are submitting, in a separate appendix, relevant materials from these dockets. As discussed previously, under the Clean Air Act,[161] Administrative Procedure Act and relevant case law, Administrator Pruitt must consider this information to assess the impacts of the Repeal Proposal and the potential delays in achieving critical reductions of GHG emissions, but has unlawfully failed to do so thus far.

c. To Avoid the Most Devastating Impacts of Climate Change, the United States Must Act *Now* to Reduce Greenhouse Gas Emissions from Power Plants.

i. <u>Delays in achieving emissions reductions exponentially increase the risks of calamitous harm and mean that much more expensive steps will be required later to reduce harms from climate change.</u>

The hazards posed by GHG emissions for health and welfare are inherently time-sensitive. Because CO_2 is long-lived in the atmosphere, each year's emissions add to the accumulated total of CO_2 already in the atmosphere, building year after year to ever higher

[160] National Intelligence Council, Implications for US National Security of Anticipated Climate Change (2016), https://www.dni.gov/index.php/newsroom/reports-publications/reports-publications-2016/item/1629-implications-for-us-national-security-of-anticipated-climate-change; Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey (SLVAS) Report (2018), https://reliefweb.int/report/world/department-defense-climate-related-risk-dod-infrastructure-initial-vulnerability; Gregg Garfin, Climate Change Impacts and Adaptation on Southwestern DoD Facilities (2017), https://www.serdp-estcp.org/Program-Areas/Resource-Conservation-and-Resiliency/Infrastruct7607ure-Resiliency/Vulnerability-and-Impact-Assessment/RC-2232; USDOD 2015.
[161] *E.g.*, 42 U.S.C. § 7607(d)(9)(A).

concentrations.[162] The longer we wait to reduce emissions, the greater the risks will be, and the greater the cost of reducing those risks in the future. Action too long delayed may put a sustainable climate out of reach altogether.

In 2014, the White House issued a report demonstrating that the cost of delay is not only extremely steep but also potentially irreversible, and rises exponentially as delay continues.[163] As the report notes, the costs of delay are "driven by fundamental elements of climate science and economics" [164] because CO_2 remains in the atmosphere for hundreds of years after it is emitted. Any mitigation policy that is delayed must therefore "take as its starting point a higher atmospheric concentration of CO_2."[165] Based on conservative assumptions (omitting, for example, the effects of crucial tipping points such as methane releases from melting permafrost), the report values the cost of *delay alone* at no less than $150 billion (or 0.9 percent of global output) for every year that action is delayed, if that delay causes global temperatures to overshoot a threshold increase of two degrees Celsius by just one additional degree (relative to pre-industrial levels).[166] Every additional degree of warming thereafter will sharply raise the annual damage above this increment (for example, an *additional* 1.2 percent of global output for a rise in temperatures to the next degree Celsius).[167] These costs are not one-time, but are incurred permanently and cumulatively, year after year.[168] Conversely, a delayed policy to mitigate climate change, once implemented, "must be more stringent and thus more costly in subsequent years."[169] Summarizing numerous peer-reviewed scientific and economic studies, the report concluded that "delay substantially decreases the chances that even concerted efforts in the future will hit" aggressive climate targets.[170]

The current proposal to repeal the CPP while putting nothing in its place—and adopting an interpretation of the BSER that may needlessly exclude cost-effective and efficacious measures for reducing carbon pollution from the power sector—flouts these fundamental and well-understood principles. The mere act of delaying reductions of power plant GHG emissions itself exacerbates the harm they cause, an effect completely ignored in the Repeal Proposal. It is arbitrary, capricious, and unlawful for this reason alone.

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[162] "According to the National Research Council, 'Emissions of CO_2 from the burning of fossil fuels have ushered in a new epoch where human activities will largely determine the evolution of Earth's climate. Because CO2 in the atmosphere is long lived, it can effectively lock Earth and future generations into a range of impacts, some of which could become very severe. Therefore, emission reduction choices made today matter in determining impacts experienced not just over the next few decades, but in the coming centuries and millennia.''' Standards of Performance for Greenhouse Gas Emissions From New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64, 510, 64,517 (Oct. 23, 2015) (citation omitted).
[163] The White House, The Cost of Delaying Action to Stem Climate Change, at 2 (July 29, 2014), https://obamawhitehouse.archives.gov/the-press-office/2014/07/29/white-house-report-cost-delaying-action-stem-climate-change.
[164] *Id.* at 4.
[165] *Id.*
[166] *Id.* at 4-5 (citing the DICE model (Nordhaus (2013)).
[167] *Id.*
[168] *Id.* at 2.
[169] *Id.* at 1.
[170] *Id.* at 5.

Until this administration's recent reversal of prior U.S. policy,[171] every country in the world endorsed the effort to act now in order to keep temperature increases and their enormous costs at a minimum. As part of its efforts under the Paris Agreement to combat climate change, the United States committed to the target of holding the long-term global average temperature "to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels".[172] The Paris Agreement codifies the international consensus that climate change is an "urgent threat" of global concern.[173] The Agreement also requires a "well below 2°C" climate target because 2°C of warming is no longer considered a safe guardrail for avoiding catastrophic climate impacts and runaway climate change.[174] EPA carefully considered the CPP's impact on this and other international efforts to combat global climate change when issuing the rule;[175] the Repeal Proposal, on the other hand, does not mention the global effects of that action, let alone explain why EPA's earlier conclusions were incorrect.

Instead of delay, immediate and aggressive GHG emissions reductions are necessary to keep warming well below a 2°C rise above pre-industrial levels. The U.S. is the world's second-largest emitter of CO_2 from fossil fuels,[176] and in 2016, power plant emissions contributed about

[171] On December 12, 2015, the United States and 194 other nation-states meeting in Paris at the 2015 United Nations Framework Convention on Climate Change Conference of the Parties consented to the Paris Agreement, committing its parties to take action to tackle dangerous climate change. Although the Trump administration has announced its intent to leave the Paris Agreement, the U.S. remains a party to it until it formally withdraws pursuant to Article 28 of the Paris Agreement. Paris Agreement Art. 28.
[172] Paris Agreement Art. 2(1)(a).
[173] *See* Paris Agreement Recitals.
[174] Hansen, James *et al.*, Target atmospheric CO_2: Where should humanity aim?, 2 THE OPEN ATMOSPHERIC SCI. J. 217 (2008); Anderson, Kevin and Alice Bows, Beyond 'dangerous' climate change: emission scenarios for a new world, 369 PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOC'Y 20 (2011); Hansen, James *et al*., Assessing "dangerous climate change": Required reduction of carbon emissions to protect young people, future, generations and nature, 8 PLOS ONE e81648 (2013); IPCC [Intergovernmental Panel on Climate Change], Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, [Core Writing Team, R.K. Pachauri & L.A. Meyer (eds.)], at 72-73, IPCC, Geneva, Switzerland (2014), http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full_wcover.pdf; U.N. Subsidiary Body for Scientific and Technological Advice, Report on the Structured Expert Dialogue on the 2013-2015 review, FCCC/SB/2015/1NF.1 (2015), http://unfccc.int/resource/docs/2015/sb/eng/inf01.pdf; Hansen, James *et al*., Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observation that 2°C global warming could be dangerous, 16 ATMOS. CHEM. & PHYSICS 3761 (2016); Schleussner, Carl-Friedrich *et al*., Differential climate impacts for policy-relevant limits to global warming: the case of 1.5C and 2C, 7 EARTH SYSTEMS DYNAMICS 327 (2016).
[175] "This final rule demonstrates to other countries that the U.S. is taking action to limit GHG emissions from its largest emission sources, in line with our international commitments. The impact of GHGs is global, and U.S. action to reduce GHG emissions complements and encourages ongoing programs and efforts in other countries." Clean Power Plan, 80 Fed. Reg. at 64,700.
[176] International Energy Agency, *CO_2 Emissions from Fuel Combustion: Overview* at 6 (2017), www.iea.org/publications/freepublications/publication/CO2EmissionsFromFuelCombustion2017Overview.pdf.

35 percent of U.S. energy-related CO_2.[177] As discussed below, aggressive climate action requires a steep reduction in emissions from the transportation sector, which recently overtook power plants as the largest U.S. source of GHG emissions. That reduction will entail vehicle electrification, creating additional demand for clean power generation. Without major reductions in U.S. power plant emissions, success in keeping temperatures below a 2°C rise above pre-industrial levels is extremely unlikely.

The IPCC's Fifth Assessment Report and other expert assessments have established global carbon budgets, which correspond to the total amount of CO_2 (and CO_2-equivalent emissions of other GHGs) that can be released into the atmosphere while maintaining some probability of staying below a given temperature target. According to the IPCC, the total cumulative anthropogenic emissions of CO_2 from 2011 onward must remain below about 1,000 gigatonnes ($GtCO_2$) for a 66 percent probability of limiting warming to 2°C above pre-industrial levels, and to 400 $GtCO_2$ from 2011 onward for a 66 percent probability of limiting warming to 1.5°C.[178] These total carbon budgets have been reduced to 850 $GtCO_2$ and 240 $GtCO_2$, respectively, from 2015 onward.[179] Since global CO_2 emissions in 2015 alone totaled 36 $GtCO_2$,[180] humanity is rapidly consuming its remaining carbon budget.

Published scientific studies have estimated the United States' portion of the global carbon budget by allocating the remaining budget across countries based on equity, economics, and other factors. Estimates of the U.S. carbon budget vary depending on the temperature target used by the study (1.5°C versus 2°C), the likelihood of meeting the temperature target (50 percent versus 66 percent probability), the equity principles used to apportion the global budget among countries, and whether a cost-optimal model was employed. As detailed below, the U.S. carbon budget for limiting temperature rise to well below 2°C has been estimated at 38 $GtCO_2$, while the budget for limiting temperature rise to 2°C ranges from 34 $GtCO_2$ to 158 $GtCO_2$.

To estimate the remaining U.S. carbon budget through 2100 based on a cost-optimal model, researchers calculated averages across five IPCC-AR5 sharing principles: capability, equal per capita, greenhouse development rights, equal cumulative per capita, and constant emissions ratio.[181] Using this methodology, these researchers estimated the U.S. carbon budget at 57 $GtCO_2eq$ for six well-mixed GHGs (which corresponds to CO_2-specific emissions of ~38 $GtCO_2$)[182] for a 50 percent chance of constraining global average temperature rise to 1.5°C by

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[177] In 2016, carbon dioxide emissions from the U.S. electric power sector were 1,821 million metric tons. U.S. Energy Information Administration [hereinafter USEIA], Frequently Asked Questions, www.eia.gov/tools/faqs/faq.php?id=77&t=11 (accessed Apr. 20, 2018).

[178] IPCC, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)] , at 63-64 & tbl. 2.2, IPCC, Geneva, Switzerland (2014).

[179] Rogelj, Joeri *et al*., Differences between Carbon Budget Estimates Unraveled, 6 NATURE CLIMATE CHANGE 245, at tbl. 2 (2016).

[180] *See* Le Quéré, Corrine *et al.*, Global Carbon Budget 2016, 8 EARTH SYST. SCI. DATA 605 (2016), www.globalcarbonproject.org/carbonbudget/16/data.htm.

[181] Robiou du Pont, Yann *et al*., Equitable mitigation to achieve the Paris Agreement goals, 7 NATURE CLIMATE CHANGE 38 (2017).

[182] *Id.* Quantities measured in $GtCO_2eq$ refers to the mass emissions of six well-mixed GHGs converted into CO_2-equivalent values, while quantities measured in $GtCO_2$ refer to mass emissions of just CO_2 itself. *See* Meinshausen, Malte *et al.*, Greenhouse gas emission targets for limiting global warming to 2 degrees Celsius, 458 NATURE 1158

2100, which is the only target among the studies that is consistent with the "well below 2°C" temperature commitment of the Paris Agreement. The U.S. carbon budget for a 66 percent probability of keeping warming below 2°C was estimated at 104 $GtCO_2eq$ for six well-mixed GHGs (which corresponds to CO_2-specific emissions of ~69 $GtCO_2$).[183]

For a 66 percent probability of keeping warming below 2°C, another study estimated the U.S. carbon budget at 34 $GtCO_2$ based on an "equity approach" for allocating the global carbon budget, and 123 $GtCO_2$ under an "inertia approach."[184] The equity approach allocates national carbon budgets based on population size and provides for equal per capita emissions across countries, whereas the inertia approach bases sharing on countries' current emissions. Also using a 66 percent probability of keeping warming below 2°C, a third study estimated the U.S. carbon budget at 78 to 97 $GtCO_2$ based on a contraction and convergence framework, in which all countries adjust their emissions over time to achieve equal per capita emissions.[185] Although the contraction and convergence framework corrects current emissions inequities among countries over a specified time frame, it does not account for inequities stemming from differences in historical emissions. When accounting for historical responsibility, the study estimated that the United States has an additional cumulative carbon debt of 100 $GtCO_2$ as of 2013.[186] Using a non-precautionary 50 percent probability of limiting global warming to 2°C, an additional study estimated the U.S. carbon budget at 158 $GtCO_2$ based on a "blended" approach of sharing principles that averages the "inertia" and "equity" approaches.[187] Of that 158 $GtCO_2$ budget, 91 $GtCO_2$ was categorized as "committed" emissions through the lifetimes of existing CO_2-emitting infrastructure (unless they are retired early).[188]

Although the cited studies differ in terms of certain assumptions and normative emphases, they all tell the same fundamental story: under *any* conceivable scenario, the remaining U.S. carbon budget for limiting global average temperature rise to 1.5°C or 2°C is extremely small and is rapidly being consumed. In 2016, the U.S. 2016 power sector emitted 1.821 $GtCO_2$.[189] Regardless of whether the total remaining U.S. carbon budget is 38 $GtCO_2$ (to limit temperature rise to well below 2°C) or in the range of 34 $GtCO_2$ to 158 $GtCO_2$ (to hold the rise to 2°C), the country must rapidly reduce and then eliminate its power plant emissions. By delaying critical emission reductions from power plants, the Repeal Proposal could seriously

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(2009) [hereinafter Meinshausen *et al*. 2009]. We used a conversion factor of 1 $GtCO_2$ = 1.5 $GtCO_2eq$ based on Table 1 in Meinshausen *et al*. (2009).

[183] Robiou du Pont, Yann *et al*., Equitable mitigation to achieve the Paris Agreement goals, 7 NATURE CLIMATE CHANGE 38 (2017). 1 $GtCO_2$ = 1.5 $GtCO_2eq$ based on Table 1 in Meinshausen *et al*. (2009).

[184] Peters, Glen P. *et al.*, Measuring a fair and ambitious climate agreement using cumulative emissions, 10 ENVTL. RES. LETT. 105004 (2015).

[185] Gignac, Renaud and H. Damon Matthews, Allocating a 2C cumulative carbon budget to countries, 10 ENVTL. RES. LETT. 075004 (2015). In a contraction and convergence approach, national emissions are allowed to increase or decrease for some period of time until they converge to a point of equal per capita emissions across all regions at a given year, at which point all countries are entitled to the same annual per capita emissions.

[186] *Id.*

[187] Raupach, Michael *et al*., Sharing a quota on cumulative carbon emissions, 4 NATURE CLIMATE CHANGE 873, at supp. fig. 7 (2014).

[188] *Id.*

[189] USEIA, "Frequently Asked Questions," www.eia.gov/tools/faqs/faq.php?id=77&t=11 (last accessed Apr. 20, 2018).

imperil the United States' ability to avoid the most harmful impacts of climate change. Yet it has given no consideration to this key consequence of its proposed action.

ii. Reductions in power sector emissions are particularly critical in light of the growing electrification of the transportation sector.

In 2016, the U.S. transportation sector surpassed the electric sector for the first time as the nation's largest emitter of GHGs.[190] In 2017, the transportation sector emitted 1,904 MMT CO_2 —36.9 percent of the national total CO_2 emissions—compared to 1,753 MMT CO_2 in the electric power sector, 34.0 percent of the national total.[191] Moreover, transportation sector emissions have increased every year since 2012.[192] U.S. transportation-related emissions vastly outstrip those of any other country; in 2015, for instance, U.S. CO_2 emissions from the transportation sector were more than double those of China and were more than 83 percent greater than those of all 26 of Europe's OECD countries combined.[193] Without a steep reduction in U.S. transportation sector emissions in the coming years and decades, the U.S. will be unable to stay within the confines of its carbon budget.

Fortunately, vehicle electrification technologies have made major advances in the last decade, and electric vehicles ("EVs") are occupying an increasingly greater share of the U.S. domestic market. Between 2012 and 2016, the U.S. market for EVs increased by 32 percent annually, and between July 2016 and June 2017, domestic EV sales were up 45 percent over the previous 12-month period.[194] If the nation were to sustain a 40 percent growth rate for the next six years, EVs would account for 10 percent of all U.S. vehicle sales in 2023 and possibly close to 20 percent by 2025.[195] And forecasts for electric vehicle growth are increasingly (and, in some cases, dramatically) being revised upward as market observers—including major oil producers—become more aware of the transformational potential of these technologies. For example, between 2015 and 2016, OPEC quintupled its forecast of electric vehicle sales between 2020 and 2040.[196]

In addition, an increasing number of countries are enacting ambitious policies to advance EV market penetration. For example, nations such as Norway, the Netherlands, India, France, and the UK have either enacted laws or announced policies to phase out new gas-powered cars in

[190] USEIA, *Power sector carbon dioxide emissions fall below transportation sector emissions*, Today in Energy (Jan. 19, 2017), www.eia.gov/todayinenergy/detail.php?id=29612.
[191] USEIA, *Monthly Energy Review* at 183-187 (Mar. 2018), https://www.eia.gov/totalenergy/data/monthly/pdf/mer.pdf.
[192] *Id.* at 186.
[193] International Energy Agency, *CO_2 Emissions from Fuel Combustion: Highlights* at 112–114 (2017), www.iea.org/publications/freepublications/publication/CO2EmissionsfromFuelCombustionHighlights2017.pdf.
[194] Peter O'Connor, *40% Growth? The Latest Electric Vehicle Sales Numbers Look Good*, UCS Blog (July 20, 2017) http://blog.ucsusa.org/peter-oconnor/electric-car-rolling-sales-numbers.
[195] *Id.*
[196] Jess Shankleman, *Big Oil Just Woke Up to Threat of Rising Electric Car Demand*, Bloomberg Tech., (July 14, 2017), www.bloomberg.com/news/articles/2017-07-14/big-oil-just-woke-up-to-the-threat-of-rising-electric-car-demand.

favor of EVs (and, in some cases, hybrids) between 2025 and 2040,[197] which will both help spur next-generation technology (making EVs increasingly economical) and put pressure on other countries—including the United States—to adopt similar policies.

Yet as the U.S. vehicle fleet becomes increasingly electrified, the emission reduction opportunities for the transportation sector will be greatly undercut without a concomitant movement away from fossil fuel-fired sources of electricity generation and toward renewable resources. Although EVs themselves produce no CO_2 emissions from operating, they do emit lifecycle GHGs due to their manufacture and the fact that they may be powered by electricity from CO_2-emitting power plants. Thus, the extent of those lifecycle emissions varies significantly based upon where any given EV is located; car owners charging EVs in a region of the country powered by a higher percentage of renewable generators will produce fewer emissions compared to owners charging in a region with a high percentage of fossil fuel- (and especially coal-) fired units. According to a 2015 study conducted by the Union of Concerned Scientists ("UCS"), EVs in every region of the country produce fewer lifecycle GHG emissions than a gas-powered car of average fuel efficiency (which, as of the study, was 29 MPG).[198] However, the specific threshold at which EVs reach parity with gas-powered cars varies significantly from one region to the next depending primarily on the generation mix used to generate electricity for a given area. For example, whereas an average EV charged in upstate New York produces equivalent lifecycle CO_2 emissions to a gas-powered car achieving 135 MPG, an average EV charged in Kansas produces equivalent emissions to a gas-powered car achieving just 35 MPG.[199]

Thus, the use of high-emitting resources to generate electricity can greatly erode the climate benefits of electrifying the transportation fleet. On the other hand, UCS reports that by transitioning to an 80 percent zero-carbon electric grid by 2050, the U.S. can reduce average lifecycle EV emissions by 60 percent.[200] Under this scenario, the lifecycle emissions of an average EV would be the same as those from a gas-powered car of 300 MPG, a major improvement over today's standards.[201] With a dwindling carbon budget and an ever-narrowing window for making critical GHG reductions, the U.S. must reduce emissions from *both* the electricity and transportation sectors in tandem. The CPP is a critical step toward this goal and must be preserved and strengthened, rather than repealed.

d. Despite Recent Declines, the Power Sector Remains the Largest Stationary Source of Climate-Destabilizing Emissions; No Strategy for Curbing Climate Change Can Succeed Without Reducing Emissions from this Sector.

[197] Danielle Muoio, *These countries are banning gas-powered vehicles by 2040*, Business Insider (Oct. 23, 2017), www.businessinsider.com/countries-banning-gas-cars-2017-10/#norway-will-only-sell-electric-and-hybrid-vehicles-starting-in-2030-1.
[198] UCS, *Cleaner Cars from Cradle to Grave: How Electric Cars Beat Gasoline Cars on Lifetime Global Warming Emissions* at 2 (Nov. 2015), www.ucsusa.org/clean-vehicles/electric-vehicles/life-cycle-ev-emissions#.Wh8HVYanHcs.
[199] *Id.*
[200] *Id.* at 25.
[201] *Id.*

In recent years, power sector emissions have declined, driven in large part by declining renewable energy costs, increased deployment of energy efficiency programs, and greater competitiveness of natural gas relative to coal. According to EIA, power sector emissions fell by 4.8 percent in 2016, dropping below transportation sector emissions for the first time, and fell by another 3.7 percent in 2017.[202] This decline, of course, underscores the achievability of the CPP targets. Despite the decline, the power sector remains the largest stationary source of energy-related CO_2 emissions in the United States. In 2017, emissions for this sector reached 1,821 MMT, or about 34 percent of total U.S. energy-related CO_2 emissions.[203] By comparison, transportation sector emissions were nearly 37 percent of energy-related emissions and industrial and residential/commercial sector emissions were approximately 19 and 10 percent, respectively.[204]

EIA's 2018 Annual Energy Outlook projects that, without the CPP in place, power sector emissions would reach 1,739 MMT in 2030, roughly 28 percent below 2005 levels.[205] By contrast, EIA estimates that full implementation of the CPP would reduce power sector emissions to 1,534 million metric tons in 2030, or 36.5 percent below 2005 levels.[206] According to the National Renewable Energy Laboratory ("NREL"), in the absence of policy drivers, future power sector emissions are highly dependent on future technologies and market conditions, which are inherently uncertain.[207] NREL's 2017 Standard Scenarios Report shows CO_2 power sector emissions ranging from 1,395 MMT to 1,817 MMT in 2030 depending on different assumptions, including technology cost and performance assumptions.[208]

As the Rhodium Group notes, independent of the CPP's specific emission reduction targets, the program "would have created a national regulatory framework and de facto emissions trading system that would have enabled target ratcheting as energy prices, technology costs and baseline emissions projections changed."[209] With the Repeal Proposal, "[t]hat framework will be significantly eroded, if not completely undone."[210]

These analyses illustrate the uncertainty in future power sector emissions and dependence on market factors, highlighting the importance of maintaining the CPP's regulatory structure in place to ensure that critical emission reductions from the power sector are locked in as a legal matter. Creating regulatory certainty is especially crucial in the power industry given its long-term investment strategies and long plant construction lead times. The Repeal Proposal, without

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[202] USEIA, *Monthly Energy Review* at 187 (Mar. 2018), https://www.eia.gov/totalenergy/data/monthly/pdf/mer.pdf.
[203] *Id*. at 181, 187.
[204] *Id*. at 181, 183-86.
[205] USEIA, *Annual Energy Outlook 2018,* Reference Case Table A18 "Energy-related carbon dioxide emissions by sector and source" and CPP Side Case Table "Energy-Related Carbon Dioxide Emissions by Sector and Source" (Jan. 2018), https://www.eia.gov/outlooks/aeo/.
[206] *Id.*
[207] Wesley Cole *et al*., *2017 Standard Scenarios Report: A U.S. Electricity Sector Outlook*, U.S. Department of Energy (Oct. 2017), https://www.nrel.gov/docs/fy18osti/68548.pdf.
[208] *Id.*; Cole, Wesley *et al.*, Standard Scenarios Results Viewer, National Renewable Energy Laboratory, https://openei.org/apps/reeds/# (last accessed Apr. 20, 2018).
[209] John Larsen and Whitney Herndon, *What the CPP Would Have Done,* Rhodium Group (Oct. 9, 2017), http://rhg.com/notes/what-the-cpp-would-have-done.
[210] *Id.*

a replacement rule at least as stringent, removes that certainty and instead delays urgently needed reductions in power plant emissions.

III. CONCLUSION

The evidence of the tremendous harm posed by climate change, and the need for deep and immediate CO_2 emission reductions from power plants, is stronger now than it has ever been. Administrator Pruitt's CPP Repeal Proposal ignores this critical evidence, flouting the requirements of the Administrative Procedure Act and the governing case law interpreting it. The facts in the record leave no doubt that the CPP must be implemented and made more stringent, not repealed. The Administrator must, therefore, withdraw the Repeal Proposal and instead must enforce and strengthen the CPP.

Respectfully submitted,

CENTER FOR BIOLOGICAL DIVERSITY
CLEAN AIR COUNCIL
CLEAN AIR TASK FORCE
EARTHJUSTICE
ENVIRONMENTAL DEFENSE FUND
ENVIRONMENTAL LAW AND POLICY CENTER
MINNESOTA CENTER FOR ENVIRONMENTAL ADVOCACY
NATIONAL PARKS CONSERVATION ASSOCIATION
NATURAL RESOURCES DEFENSE COUNCIL
SIERRA CLUB
UNION OF CONCERNED SCIENTISTS