PETITION
of
Ashley Funk
to the
Pennsylvania Environmental Quality Board
Pennsylvania Department of Environmental Protection

For the promulgation of a rule to strictly limit and regulate fossil fuel carbon dioxide emissions, and to establish an effective emissions reduction strategy that will achieve safe atmospheric concentrations of carbon dioxide by 2100.

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On behalf of

Ashley Funk (Petitioner)

September 5, 2013
September 5, 2013

E. Christopher Abruzzo, Acting Secretary
Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17101

Michele Tate, Regulatory Coordinator
Environmental Quality Board
P.O. Box 8477, Harrisburg, PA, 17105-8477

Re: Petition For Promulgation of a Rule to Regulate Fossil Fuel Carbon Dioxide Emissions and to Establish an Effective Emissions Reduction Strategy That Will Achieve a Concentration of 350 ppm Atmospheric Carbon Dioxide by 2100.

On behalf of my client, Ashley Funk, I hereby submit the following Petition for Rulemaking.

Article I, Section 27 of the Pennsylvania Constitution provides: “The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania’s public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people.”

Article I, Section 27 is an explicit recognition that the state holds the air in trust for all Pennsylvanians. This is an affirmative obligation that Pennsylvania’s legislature cannot abrogate. For example, in San Carlos Apache Tribe v. Superior Court, 193 Ariz. 195, 199, 972 P.2d 179, 215 (1999), the Arizona Supreme Court recognized that “the public trust doctrine is a constitutional limitation on legislative power to give away resources held by the state in trust for its people.” The legislature cannot destroy the constitutional limits on its authority. This is especially true in Pennsylvania where the public trust doctrine is enshrined in the constitution. In short, Article I, Section 27 imposes a duty on the state of Pennsylvania to protect the state’s air – a duty that may not be abrogated by the legislature.

The Pennsylvania Department of Environmental Protection (DEP or Department) denied two earlier versions of this petition citing 35 P.S. §4004.2,¹ which prohibits the Environmental Quality Board (EQB) from adopting an ambient air quality standard for a

¹ The denial letter cited §4002.2(d) but we believe the letter was actually referring to §4004.2.
specific pollutant that is more stringent than an air quality standard adopted by the U.S. EPA. While the previous versions and this Petition have not and do not seek the imposition of an ambient air quality standard but rather reductions in carbon dioxide emissions that will meet Pennsylvania’s obligation to seek safe atmospheric concentrations of carbon dioxide, DEP’s prior reliance on statutory law was and is improper because the legislature cannot legislate away its public trust duty. Using 35 P.S. §4004.2 to deny this petition is unconstitutional as it is inconsistent with Pennsylvania’s public trust obligations under Article I, Section 27.

The Pennsylvania Supreme Court has held that Article I, Section 27 of Pennsylvania’s Constitution “is a declaration, not of the hope that the Legislature will sanction the rights therein reserved to the people, but that such rights are thereby ‘recognized and unalterably established.’” Commonwealth v. Gettysburg, 8 Pa.Cmwlth. 231, 243 (1973). The Supreme Court went on to say that the rights declared in Article I remain “inviolate.” Id.

In short, Article I, Section 27 gives the Pennsylvania Department of Environmental Protection all the authority it needs to protect Pennsylvania’s air, even without legislative action. The DEP cannot rely on 35 P.S. §4004.2 to deny this petition, as that would be an unconstitutional application of the statute.

REQUEST FOR ADOPTION OF A RULE

Pursuant to the Pennsylvania State Constitution Article I, Section 20 “[t]he citizens have a right in a peaceable manner to assemble together for their common good, and to apply to those invested with the powers of government for redress of grievances or other proper purposes by petition…”2 The petitioners, Ashley Funk and Kids vs Global Warming hereby submit this petition for rulemaking on behalf of themselves, the citizens of the State of Pennsylvania, and present and future generations of minor children. This petition conforms to the rules for petitioning under Pennsylvania Code Ch. 23.1 for the Environmental Quality Board, and uses the form for petitioning supplied by the Department of Environmental Protection.3 Pa. Code 23.1(a). In addition to the form, the first and second page of this substantive petition contain the petitioners’ names, addresses, and telephone numbers. Pa. Code 23.1(a)(1). The paragraph following this one has a clear description of the action requested with suggested regulatory language. Pa. Code 23.1(a)(2)(i). Section IA and IB of this petition includes the reasons petitioners are requesting this action with the scientific and factual justifications supporting this request. Pa. Code 23.1(a)(3). Section IC contains the legal principles and justifications for this request. Pa. Code 23.1(a)(3). Finally, section ID includes the types of persons, businesses and organizations that will be affected by this regulation. Pa. Code 23.1(a)(4).

Overview of the Proposed Rule

The petitioner respectfully requests that the Pennsylvania Environmental Quality Board promulgate a rule or rules that require the Department to take the following steps in order to protect the integrity of Pennsylvania’s and the Earth’s climate by ordering actions that will result in safe concentrations of carbon dioxide so as to adequately protect our atmosphere, a public trust resource upon which all Pennsylvanians rely for their health, safety, sustenance, and security. The rule(s) should be designed to achieve this general goal through the following means:

(1) In connection with the work required by 71 P.S. § 1361.4 (the Pennsylvania Climate Change Act, Act 70), order the Department to determine the amount of carbon dioxide emitted in the Commonwealth by all fossil fuel burning sources in 2012, thereby establishing a Baseline CO\textsubscript{2} Emission Rate.

(2) Order the Department to determine the amount of carbon dioxide emitted each year from all fossil fuel burning sources in the Commonwealth, thereby establishing an Annual CO\textsubscript{2} Emission Rate for that given year.

(3) Order the Department to undertake all actions necessary to achieve at least a 6% reduction in the Annual CO\textsubscript{2} Emission Rate for 2013 compared to the Baseline Emission CO\textsubscript{2} Emission Rate, and then at least a 6% reduction in the Annual CO\textsubscript{2} Emission Rate each year compared to the Annual CO\textsubscript{2} Emission Rate for the previous year, through the year 2050. If the reduction is less than 6% for a given year, require the Department to undertake such further actions, including the imposition of greater reductions of CO\textsubscript{2}, so that the total reductions of CO\textsubscript{2} emissions will return to the rate imposed by the regulation within 12 months.

(4) Order the Department to certify the rate of reduction of the Annual CO\textsubscript{2} Emission Rate each year and to make the information used publicly available.

This Petition does not seek nor would it require the imposition of an ambient air quality standard for carbon dioxide. Rather, it relies upon the best available science which strongly indicates that a program of 6% annual reductions of fossil fuel carbon dioxide emissions starting in 2013 through 2050 will achieve a “safe” concentration of carbon dioxide that will minimize the adverse impacts of climate change spelled out more fully in this Petition. However, time is of the essence for protecting the public trust resource of Pennsylvania’s atmosphere. Delay in the imposition of these annual reductions would not only violate the Commonwealth’s duties as public trustee, but it also would require even greater annual reductions in order to “catch up” on the path to a “safe” atmosphere.

* See App. I for suggested specific language of the proposed rule.
The Petitioner

Petitioner Ashley Funk resides in Southwestern Pennsylvania in the rural town of Mount Pleasant. Ashley, age 18, has been involved in environmental activism for over four years. Growing up, she has impacted her community by promoting environmental responsibility and health. After implementing a recycling program and anti-litter campaign in her town, Ashley has moved on to making Southwestern Pennsylvania and her nation aware of the larger scale environmental injustices of today. Ashley tells her story in the mini-documentary film *Stories of TRUST: Calling for Climate Recovery (TRUST Pennsylvania)*, attached to this petition.4

Living in the area that has been named the "Saudi Arabia of natural gas drilling", she wishes to educate people about the health hazards of practices such as Marcellus Shale hydro-fracturing. In her surrounding area, public health and water resources have been jeopardized by extracting these fossil fuels. In addition to the unsafe practice of hydro-fracking, Ashley wishes to bring an end to other harmful fossil fuel extraction practices such as mountain top removal coal mining. By implementing renewable energy technology across our nation, she believes that we can bring an end to the devastating effects of fossil-fuel extraction and climate change.

Living in Southwestern Pennsylvania, the effects of climate change have impacted her surrounding community. Extreme weather conditions have enveloped the area in the past few years. In the winters, Pennsylvania has been coping with extreme blizzards; in the summers, the area has encountered record high heat waves as well as a series of storms featuring high winds and tornadoes. Ashley believes that if climate change continues to progress, areas across the United States, including her hometown, will be forced to handle extreme weather conditions that worsen with time. Through research and experience, Ashley has recognized that our country's dependence on fossil fuels has dramatically impacted our economy, health, and environment. She believes that by working together, our nation can move forward into a future of sustainable energy. With Pennsylvania and the United States as leaders, nations around the world can work together to solve the energy and climate crisis with our progressing technological solutions. If our society does not adopt a sustainable future, she believes, climate change will continue to irreversibly destroy and disrupt the only planet we have to call home. In 2050, when the worst effects of climate change are projected to be seen, Ashley will be 56.

The petitioner, as a Pennsylvania youth, represents the youngest living generation of public trust beneficiaries, and have a profound interest in ensuring that the climate remains stable enough to ensure their rights to a livable future. A livable future includes the opportunity to drink clean water and abate thirst, to grow food that will abate hunger, to be free from imminent property damage caused by extreme weather events, and to enjoy the abundant and rich biodiversity on this small planet. The petitioner requests the

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4 *TRUST Pennsylvania* is a part of this petition and should be preserved in all records of this action.
promulgation of the rule herein proposed in order to protect their interests in a livable future, and an inhabitable Pennsylvania.

I. STATEMENT OF REASONS: The EQB should grant this petition and promulgate the proposed rule for the following reasons:

A. THE SCIENCE UNEquivocALLY SHOWS THAT ANTHROPOGENIC CLIMATE CHANGE IS OCCURRING AND IS THREATENING THE STABILITY OF THE GLOBAL CLIMATE.

1. According to the United States Global Change Research Program\(^5\), global warming is occurring and adversely impacting the Earth’s climate.\(^6\) The present rate of global heating is occurring as a result of human activities that release heat-trapping greenhouse gases (GHGs) and intensify the Earth’s natural greenhouse effect, at an accelerated rate, thereby changing Earth’s climate.\(^7\) This abnormal climate change is unequivocally human-induced\(^8\), is occurring now, and will continue to occur unless drastic measures are taken to curtail it\(^9\). Climate change is damaging both natural and human systems, and if unrestrained, will alter the planet’s

\(^5\) “The U.S. Global Change Research Program (USGCRP) coordinates and integrates federal research on changes in the environment and their implications for society.” The organization’s vision is to produce “[a] nation, globally engaged and guided by science, meeting the challenges of climate and global change.” The organization is comprised of “[t]hirteen departments and agencies [that] participate in the USGCRP…steered by the Subcommittee on Global Change Research under the Committee on Environment and Natural Resources, overseen by the Executive Office of the President, and facilitated by an Integration and Coordination Office.” http://www.globalchange.gov/about.

\(^6\) UNITED STATES GLOBAL CHANGE RESEARCH PROGRAM (USGCRP), GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 13 (2009) available at http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf [hereinafter Global Climate Change Impacts] (“Human activities have led to large increases in heat-trapping gases over the past century. Global average temperature and sea level have increased, and precipitation patterns have changed.”).


\(^8\) USGCRP, Global Climate Change Impacts at 12 (2009).

\(^9\) Id. (“Future climate change and its impacts depend on choices made today.”); IPCC, AR4 1.1 (2007) (“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.”).
habitability.\textsuperscript{10}

2. According to the United States Environmental Protection Agency (EPA), “[T]he case for finding that greenhouse gases in the atmosphere endanger public health and welfare is compelling and, indeed, overwhelming.”\textsuperscript{11} The EPA further stated in April 2009 that “[t]he evidence points ineluctably to the conclusion that climate change is upon us as a result of greenhouse gas emissions, that climate changes are already occurring that harm our health and welfare, and that the effects will only worsen over time in the absence of regulatory action.”\textsuperscript{12}

3. We human beings have benefited from living on a planet that has been remarkably hospitable to our existence and provided conditions that are just right for human life to expand and flourish.\textsuperscript{13} The Earth is a “Goldilocks” planet with an atmosphere that has fewer GHGs than that of Venus (which is too hot), and more than that of Mars (which is too cold), which is just perfect for the life that has developed on planet Earth.\textsuperscript{14}

4. GHGs in the atmosphere act like a blanket over the Earth to trap the heat that it receives from the sun.\textsuperscript{15} More GHGs in the atmosphere means that more heat is being retained on Earth, with less heat radiating back out into space.\textsuperscript{16} Without this greenhouse effect, the average surface temperature of our planet would be 0°F (-18°C) instead of 59°F (15°C).\textsuperscript{17} Scientists have understood this basic mechanism of global warming since the late-nineteenth century.\textsuperscript{18}

\textsuperscript{10} USGCRP, Global Climate Change Impacts at 12 (2009) (“Thresholds will be crossed, leading to large changes in climate and ecosystems.”).
\textsuperscript{11} Proposed Endangerment Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 18886, 18904 (April 24, 2009)(to be codified in 40 C.F.R. Chapter 1) (emphasis added).
\textsuperscript{12} Id.
\textsuperscript{13} John Abatzoglou et al., A Primer on Global Climate Change and Its Likely Impacts, in CLIMATE CHANGE: WHAT IT MEANS FOR US, OUR CHILDREN, AND OUR GRANDCHILDREN 11, 15-22 (Joseph F. C. DiMento & Pamela Doughman eds., MIT Press 2007) (“The earth’s climate system can be thought of as an elaborate balancing act of energy, water, and chemistry involving the atmosphere, oceans, ice masses, biosphere, and land surface.”).
\textsuperscript{14} JAMES HANSEN, STORMS OF MY GRANDCHILDREN 224-225 (2009); See John Abatzoglou et al., A Primer on Global Climate Change and Its Likely Impacts, in CLIMATE CHANGE: WHAT IT MEANS FOR US, OUR CHILDREN, AND OUR GRANDCHILDREN at 23.
\textsuperscript{15} John Abatzoglou et al., A Primer on Global Climate Change and Its Likely Impacts, in CLIMATE CHANGE: WHAT IT MEANS FOR US, OUR CHILDREN, AND OUR GRANDCHILDREN at 22.
\textsuperscript{16} Id. at 16-17.
\textsuperscript{17} Id. at 17.
\textsuperscript{18} See id. at 35 (describing the efforts of Swedish chemist Svante Arrhenius).
5. Human beings have significantly altered the chemical composition of the Earth’s atmosphere and its climate system.\(^{19}\) We have changed the atmosphere and Earth’s climate system by engaging in activities that produce, or release GHGs into the atmosphere.\(^{20}\) Carbon dioxide (CO\(_2\)) is the key GHG, and there is evidence that its emissions are largely responsible for the current warming trend.\(^{21}\) Although much of the excess carbon dioxide is absorbed by the oceans, plants and forests, the increase of GHG concentrations resulting from historic and present human activities has altered the Earth’s ability to maintain the delicate balance of energy between that which it receives from the sun and that which it radiates back out into space.\(^{22}\)

6. The current CO\(_2\) concentration in our atmosphere is over 390 ppm\(^{23}\) (compared to the pre-industrial concentration of 280 ppm) and is quickly approaching the dangerous level of 400 ppm.\(^{24}\) Current atmospheric GHG concentrations are likely the highest they have been in the last 800,000 years.\(^{25}\)

\(^{19}\) Naomi Oreskes, *The Scientific Consensus on Climate Change, in CLIMATE CHANGE: WHAT IT MEANS FOR US, OUR CHILDREN, AND OUR GRANDCHILDREN* 65, 93 (Joseph F. C. DiMento & Pamela Doughman eds., MIT Press 2007) (“We have changed the chemistry of our atmosphere, causing sea level to rise, ice to melt, and climate to change. There is no reason to think otherwise.”).

\(^{20}\) *Id.*


\(^{24}\) IPCC, *AR4* at 37 (“The global atmospheric concentration of CO\(_2\) increased from a pre-industrial value of about 280ppm to 379ppm in 2005.”); National Science and Technology Council, *Scientific Assessment of the Effects of Global Change on the United States* 2 (May 2008) [hereinafter *Scientific Assessment*], available at [http://www.climatescience.gov/Library/scientific-assessment/Scientific-AssessmentFINAL.pdf](http://www.climatescience.gov/Library/scientific-assessment/Scientific-AssessmentFINAL.pdf) (“The globally averaged concentration of carbon dioxide in the atmosphere has increased from about 280 parts per million (ppm) in the 18\(^{th}\) century to 383 ppm in 2007.”); Environmental Protection Agency (EPA), *Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act* 17 (December 9 2009) [hereinafter *TS Endangerment Findings*].

\(^{25}\) Dieter Lüthi et al., *High-resolution carbon dioxide concentration record 650,000-800,000 years before present* 453 Nature 379, 379-382 (May 2008) available at [http://www.nature.com/nature/journal/v453/n7193/full/nature06949.html](http://www.nature.com/nature/journal/v453/n7193/full/nature06949.html) (prior to this
7. Concentrations of other GHGs in the atmosphere have also increased from human activities. Atmospheric concentrations of methane, for example, have increased nearly 150% since the pre-industrial period. Concentrations of nitrous oxide have also increased.

8. Humans not only continue to add GHGs into the atmosphere at a rate that outpaces their removal through natural processes, but the current and projected CO₂ increase, for example, is about one hundred times faster than has occurred over the past 800,000 years. This increase has to be considered in light of the lifetime of greenhouse gases in the atmosphere. In particular, a substantial portion of every ton of CO₂ emitted by humans persists in the atmosphere for as long as a millennium or more. The current concentrations of GHGs in the atmosphere therefore, are the result of both historic and current emissions.

9. According to the EPA, in 2009, Pennsylvania was responsible for emitting 243.37 metric million tons of CO₂ from fossil fuel combustion. Only five percent of that

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26 EPA, TS Endangerment Findings at 18 (“The global atmospheric concentration of methane has increased from a pre-industrial value of about 715 parts per billion (ppb) to 1732 ppb in the early 1990s, and was 1782 ppb in 2007- a 149% increase from pre-industrial levels.”).

27 Id. at 19.

28 Id. at ES-2 (“Atmospheric GHG concentrations have been increasing because anthropogenic emissions have been outpacing the rate at which GHGs are removed from the atmosphere by natural processes over timescales of decades to centuries.”).


30 James E. Hansen et al., Target Atmospheric CO₂: Where Should Humanity Aim? 2 OPEN ATMOS. SCI. 217, 220 (2008); See also EPA, TS Endangerment Findings at 16 (“Carbon cycle models indicate that for a pulse of CO2 emissions, given an equilibrium background, 50% of the atmospheric increase will disappear within 30 years, 30% within a few centuries, and the last 20% may remain in the atmosphere for thousands of years.”); John Abatzoglou et al., A Primer on Global Climate Change and Its Likely Impacts, in CLIMATE CHANGE: WHAT IT MEANS FOR US, OUR CHILDREN, AND OUR GRANDCHILDREN 11, 29 (Joseph F. C. DiMento & Pamela Doughman eds., MIT Press 2007) (“Since CO2 has a lifetime of over one hundred years, these emissions have been collecting for many years in the atmosphere.”).

carbon is sequestered by the states private and public forests annually.\textsuperscript{32} Pennsylvania is the third largest CO\textsubscript{2} emitter after Texas and California. \textsuperscript{33} At 22.96 metric tons per year, Pennsylvania’s per capita emissions were higher than the national average of 21 metric tons per year in 2007.\textsuperscript{34} Pennsylvania’s emissions are projected to increase through 2020 based on historical data through 2005.\textsuperscript{35}

10. One key observable change is the rapid increase in recorded global surface temperatures.\textsuperscript{36} As a result of increased atmospheric GHGs from human activities, based on fundamental scientific principles, the Earth has been warming as scientists have predicted.\textsuperscript{37} The increased concentrations of greenhouse gases in our atmosphere, primarily CO\textsubscript{2},\textsuperscript{38} have raised global surface temperature by 1.4°F (0.8°C) in the last one hundred to one hundred fifty years.\textsuperscript{39} In the last thirty years, the acceleration of change has intensified as the Earth has been warming at a rate three times faster than that over the previous one hundred years.\textsuperscript{40}

\begin{itemize}
\item \textsuperscript{32} \textit{Carbon Sequestration}, Pennsylvania Department of Conservation and Natural Resources, \url{http://www.dcnr.state.pa.us/info/carbon/index.aspx}
\item \textsuperscript{33} \textit{CO\textsubscript{2} Emissions form Fossil Fuel Combustion – Million /metric Tons CO\textsubscript{2} (MMTCO\textsubscript{2})}, \url{http://www.epa.gov/statelocalclimate/documents/pdf/CO2FFC_2009.pdf}
\item \textsuperscript{34} Daniel J. Wiess, \textit{The Clean and Clear Winners}, Center for American Progress (October 23, 2008) \url{http://www.americanprogress.org/issues/2008/10/emissions_interactive.html}
\item \textsuperscript{35} \textit{Inventory and Projections of GHG Emissions}, Pennsylvania Department of Environmental Protection, available at \url{http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-77715/06%20Chapter%203%20I&F.pdf}
\item \textsuperscript{36} National Science and Technology Council, \textit{Scientific Assessment} at 51; IPCC, \textit{AR4} at 30; USGCRP, \textit{Global Climate Change Impacts} at 19; EPA, \textit{TS Endangerment Findings} 26-30; National Aeronautics and Space Administration (NASA) & Goddard Institute for Space Studies (GISS), \textit{Global Surface Temperature}, \url{http://climate.nasa.gov/keyIndicators/#globalTemp} (illustrating the change in global surface temperatures) (last visited April 7, 2011).
\item \textsuperscript{37} IPCC, \textit{AR4} at 39; USGCRP, \textit{Global Climate Change Impacts} at 13; EPA, \textit{TS Endangerment Findings} at 48.
\item \textsuperscript{39} EPA, \textit{TS Endangerment Findings} at ES-2 (“Global mean surface temperatures have risen by 1.3 ± 0.32°F (0.74°C ± 0.18°C) over the last 100 years.”); See J. Hansen et al., NASA & GISS, \textit{Global Surface Temperature Change} (August 3, 2010); NASA, \textit{Climate Change: Key Indicators}, \url{http://climate.nasa.gov/keyIndicators} (last visited April 7, 2011); John Abatzoglou et al., \textit{A Primer on Global Climate Change and Its Likely Impacts, in Climate Change: What It Means for Us, Our Children, and Our Grandchildren} 11, 15-22 (Joseph F. C. DiMento & Pamela Doughman eds., MIT Press 2007).
\item \textsuperscript{40} EPA, \textit{TS Endangerment Findings} at 32 (“U.S. average annual temperatures (for the contiguous United States or lower 48 states) are now approximately 1.25°F (0.69°C)
11. Because of year-to-year variations in these thermometer readings, as with daily readings, scientists compare temperature differences over a decade to determine patterns.\textsuperscript{41} Employing this decadal scale, the surface of the planet has warmed at a rate of roughly 0.3 to 0.4°F (0.15 to 0.2°C) per decade since the late 1970s.\textsuperscript{42} Global mean surface temperature has been decidedly higher during the last few decades of the twentieth century than at any time during the preceding four centuries.\textsuperscript{43} Global surface temperatures have been rising dramatically since 1951, and 2010 tied for the hottest year on record.\textsuperscript{44}

12. The dramatic increase of the average global surface temperature is alarming. By comparison, the global surface temperature during the last Ice Age was about 9°F (5°C) cooler than today.\textsuperscript{45} It has become quite clear that the past several decades present an anomaly, as global surface temperatures are registering higher than at any point in the past 400 years (and for the Northern Hemisphere the past 1,000 years).\textsuperscript{46}

13. The IPCC has observed that “[w]arming of the climate system is unequivocal”.\textsuperscript{47} The United States EPA has recognized the scientific consensus that has developed on the fact of global warming and its cause; that the Earth is heating up due to warmer than at the start of the 20th century, with an increased rate of warming over the past 30 years. The rate of warming for the entire period of record (1901–2008) is 0.13°F (0.072°C) per decade while the rate of warming increased to 0.58°F (0.32°C) per decade for the period 1979–2008.’’; USGCRP, \textit{Global Climate Change Impacts} at 9.
\textsuperscript{41} IPCC, \textit{AR4} at 40.
\textsuperscript{42} See NASA, \textit{Climate Change: Key Indicators, Global Land-Ocean Temperature Index}, http://climate.nasa.gov/keyIndicators/#globalTemp (last visited April 7, 2011).
\textsuperscript{43} The National Academies Press (Board on Atmospheric Sciences and Climate), \textit{Surface Temperature Reconstructions for the Last 2,000 Years} 3 (2006), available at http://www.nap.edu/catalog.php?record_id=11676.
\textsuperscript{44} NASA, \textit{Global Climate Change – Global Surface Temperature}, http://climate.nasa.gov/keyIndicators/index.cfm#globalTemp (last visited April 10, 2011) (“Global surface temperatures in 2010 tied 2005 as the warmest on record.’’); NASA, \textit{Global Climate Change}, http://climate.nasa.gov/ (last visited April 10, 2011) (“January 2000 to December 2009 was the warmest decade on record.’’).
\textsuperscript{46} USGCRP, \textit{Global Climate Change Impacts} at 19.
14. Changes in many different aspects of Earth’s climate system over the past century are consistent with this warming trend: based on straightforward scientific principles, human-induced GHG increases lead not only to warming of land surfaces, but also to the warming of oceans, increased atmospheric moisture levels, rises in the global sea level, and changes in rainfall and atmospheric air circulation patterns that affect water and heat distribution.

15. As expected (and consistent with the temperature increases in land surfaces), ocean temperatures have also increased. This has led to changes in the ocean’s ability to circulate heat around the globe; which can have catastrophic implications for the global climate system. The average temperature of the global ocean has increased significantly despite its amazing ability to absorb enormous amounts of heat before exhibiting any signs. In addition, the most significant indicator of the planet’s energy imbalance due to human-induced GHG increases, is the long-term increase in global average ocean heat content over the last 50 years, extending down to several thousand meters below the ocean surface.

16. As predicted, precipitation patterns have changed due to increases in atmospheric moisture levels and changes in atmospheric air circulation patterns; just another indicator that the Earth is warming. As the Earth warms, moisture levels are expected to increase when temperature increases because warmer air generally

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48 EPA, TS Endangerment Findings at ES-2 (“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. … Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations.”) (emphasis added).
49 IPCC, AR4 at 30.
50 Id. at 72.
51 USGCRP, Global Climate Change Impacts at 18; B.D Santer et al., Identification of human-induced changes in atmospheric moisture content, 104 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, 15248, 15248-15253 (September 25, 2007).
52 IPCC, AR4 at 30.
53 USGCRP, Global Climate Change Impacts at 18, 44.
54 Id. at 42.
55 IPCC, AR4 at 30; EPA, TS Endangerment Findings at ES-2.
56 USGCRP, Global Climate Change Impacts at 26.
57 UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP), CLIMATE CHANGE SCIENCE COMPRENDIUM 2009 at 26 (UNEP/Earthprint, 2009).
58 S. Levitus et al., Global ocean heat content 1955-2008 in light of recently revealed instrumentation problems 36 J. GEOPHYSICAL RES. LETTERS L07608 (April 2009).
59 USGCRP, Global Climate Change Impacts at 13, 17, 21, 36, 42, 74.
holds more moisture.\textsuperscript{60} In more arid regions, however, higher temperatures lead to greater evaporation.\textsuperscript{61}

17. These changes in the Earth’s water cycle increase the potential for, and severity of, severe storms, flooding and droughts.\textsuperscript{62} Storm-prone areas are already experiencing a greater chance of severe storms, and this will continue.\textsuperscript{63} Even in arid regions, increased precipitation is likely to cause flash flooding, and will be followed by drought.\textsuperscript{64}

18. These changes are already occurring: Droughts in parts of the midwestern, southeastern, and southwestern United States have increased in frequency and severity within the last fifty years, coincident with rising temperatures.\textsuperscript{65} In 2009, more than half of the United States received above normal precipitation; yet the southwestern United States (Arizona in particular) had one of its driest periods.\textsuperscript{66}

19. Based on the laws of physics and the past climate record, scientists have concluded that precipitation events will increase globally, particularly in tropical and high latitude regions, while decreasing in subtropical and mid-latitude regions,\textsuperscript{67} with longer periods between normal heavy rainfalls.\textsuperscript{68}

20. Other changes consistent with climate modeling resulting from global warming have been observed not just in the amount, intensity, and frequency of precipitation but also in the type of precipitation.\textsuperscript{69} In higher altitude and latitude regions, including in mountainous areas, more precipitation is falling as rain rather than snow.\textsuperscript{70} With early snow melt occurring because of climate change, the reduction in snowpack can aggravate water supply problems.\textsuperscript{71} In Northern Europe and the northeastern United States, a change in air currents -- caused by the warming Arctic -- brought severe snowstorms during the winters of 2009-2010 and 2010-2011.\textsuperscript{72}

\textsuperscript{60} EPA, \textit{TS Endangerment Findings} at 111.
\textsuperscript{61} \textit{Id}.
\textsuperscript{62} \textit{Id}.
\textsuperscript{63} \textit{Id}. at 120-121; USGCRP, \textit{Global Climate Change Impacts} at 27.
\textsuperscript{64} EPA, \textit{TS Endangerment Findings} at 115.
\textsuperscript{65} \textit{Id}. at 145, 143, 148.
\textsuperscript{66} \textit{State of the Climate, 2009} at S138.
\textsuperscript{67} EPA, \textit{TS Endangerment Findings} at ES-4, 74.
\textsuperscript{68} EPA, \textit{TS Endangerment Findings} at 74.
\textsuperscript{69} \textit{Id}. at ES-2.
\textsuperscript{70} USGCRP, \textit{Global Climate Change Impacts} at 18, 45.
\textsuperscript{71} \textit{Id}. at 33.
21. As expected global sea levels have also risen.\footnote{USGCRP, \textit{Global Climate Change Impacts}, at 9; EPA, \textit{TS Endangerment Findings} at ES-3; IPCC, \textit{AR4} at 30.} \footnote{IPCC, \textit{AR4} at 30.} Sea levels have been rising at an average rate of 3.1 millimeters per year based on measurements from 1993 to 2003.\footnote{NASA, \textit{Climate Change: How Do We Know?, Sea Level Rise} (last visited April 9, 2011) \url{http://climate.nasa.gov/evidence/#no4} (citing J.A. Church & N.J. White, \textit{A 20th Century Acceleration in Global Sea Level Rise} (2006) 33 Geophysical Research Letters, L01602, doi: 10.1029/2005GL024826).} Though sea levels rose about 6.7 inches over the last century; within the last decade, that rate has nearly \textit{doubled}.\footnote{EPA, \textit{TS Endangerment Findings} at ES-7; USGCRP, \textit{Global Climate Change Impacts} at 62-63.} Rising seas, brought about by melting of polar icecaps and glaciers, as well as by thermal expansion of the warming oceans, will cause flooding in coastal and low-lying areas.\footnote{USGCRP, \textit{Global Climate Change Impacts} at 109; EPA, \textit{TS Endangerment Findings} at 75.} The combination of rising sea levels and more severe storms creates conditions conducive to severe storm surges during high tides.\footnote{EPA, \textit{TS Endangerment Findings} at 86, 118.} In coastal communities this can overwhelm coastal defenses (such as levees and sea walls), as witnessed during Hurricane Katrina.\footnote{USGCRP, \textit{Global Climate Change Impacts} at 25-26, 37.}

22. Sea level is not uniform across the globe, because it depends on variables such as ocean temperature and currents.\footnote{EPA, \textit{TS Endangerment Findings} at 121.} Unsurprisingly, the most vulnerable lands are low-lying islands, river deltas, and areas that already lie below sea level because of land subsidence.\footnote{\textit{Id.} at 128; USGCRP, \textit{Global Climate Change Impacts} at 57.} Based on these factors, scientists have concluded that the threats to the United States from rising seas are the most severe on the Gulf and Atlantic Coasts.\footnote{EPA, \textit{TS Endangerment Findings} at 159; IPCC, \textit{AR4} at 52.} Worldwide, hundreds of millions of people live in river deltas and vulnerable coastlines along the southern and western coasts of Asia where rivers draining the Himalayas flow into the Indian and Pacific Oceans.\footnote{EPA, \textit{TS Endangerment Findings} at 75.}

23. In a comprehensive review of studies on sea level rise in the 21\textsuperscript{st} century published by the British Royal Society, researchers estimated the probable sea level rise for
this century between .5 and 2 meters (1 ½ to 6 ½ feet), continuing to rise for
several centuries after that, depending on future CO₂ levels and the behavior of
polar ice sheets. ⁸³

24. The IPCC estimates a 0.6-meter rise in sea level by 2100 under a worst-case
scenario that does not include contributions from the accelerated flow of major ice
sheets. ⁸⁴ Some scientists predict a 2-meter rise in sea level by 2100 if present
trends continue. ⁸⁵ "Today, rising sea levels are submerging low-lying lands,
eroding beaches, converting wetlands to open water, exacerbating coastal flooding,
and increasing the salinity of estuaries and freshwater aquifers." ⁸⁶ The impacts of
rising sea levels can be seen in many coastal locations across the nation; along the
Florida coast for instance, sea level is rising about 1 inch every 11-14 years. ⁸⁷ This
seemingly small rise in ocean levels is contributing to massive erosion, causing
many homeowners to remove beachfront property, and has lead to a decline in the
recreational value of beaches. ⁸⁸ Other coastal states (such as Maryland and
Louisiana) are also experiencing wetland loss due to rising sea levels. ⁸⁹ Scientists
have predicted that wetlands in the Mid-Atlantic region of the United States cannot
withstand a 7-millimeter per year rise in sea levels. ⁹⁰

25. As expected, mountain glaciers, which are the source of freshwater for hundreds of
millions of people, are receding worldwide because of warming temperatures. ⁹¹
Today, Glacier National Park in Montana has twenty-five glaciers larger than
twenty-five acres, down from one hundred and fifty in 1850. ⁹² The year 2009

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⁸³ R.J. Nicholls et al., Sea-level rise and its possible impacts given a ‘beyond 4°C world’

⁸⁴ IPCC, AR4 at 45.
⁸⁵ M. Vermeer & S. Rahmstorf, Global Sea Level Linked to Global Temperature, 106
PROC. NATL. ACADEMY SCI. 21527, 21531 (2009).
⁸⁶ USCCSP, Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region
⁸⁷ EPA, Saving Florida’s Vanishing Shores (March 2002) available at
⁸⁸ Id.
⁸⁹ USCCSP, Coastal Sensitivity to Sea-Level Rise at 3-4.
⁹⁰ Id. at 4.
⁹¹ See TS Endangerment Findings at 111 (“Glaciers throughout North America are
melting, and the particularly rapid retreat of Alaskan glaciers represents about half of the
estimated loss of glacial mass worldwide.”).
⁹² United States Geological Survey (Northern Rocky Mountain Science Center), Retreat
of Glaciers in Glacier National Park (June 2010),
marked the 19th consecutive year in which glaciers lost mass. Mountain glaciers are in retreat all over the world, including Mt. Kilimanjaro in Africa, the Himalayas, the Alps (99% in retreat), the glaciers of Peru and Chile (92% in retreat), and in the United States. In the Brooks Range of northern Alaska, all of the glaciers are in retreat and in southeastern Alaska 98% are in retreat.

26. Although a minor contribution to sea level rise, the melting of mountain glaciers is particularly serious in areas that rely on snow melt for irrigation and drinking water supply. In effect, a large snow pack or glacier acts as a supplemental reservoir or water tower, holding a great deal of water in the form of ice and snow through the winter and spring and releasing it in the summer when rainfall is lower or absent. The water systems of the western United States (particularly in California) and the Andean nations of Peru and Chile, among other places, all heavily rely on these natural forms of water storage. In addition to providing a more reliable water supply, the storing of precipitation as ice and snow helps moderate potential flooding.

27. Yet as temperatures warm, not only will these areas lose this supplemental form of water storage, but also severe flooding is likely to increase (because when rain falls on snow, it accelerates the melting of glaciers and snow packs). Ice is melting most dramatically at the poles. Sea ice in the Arctic oceans is expected to decrease and may even disappear entirely in coming decades.

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94 L. Thompson, Climate Change: The Evidence and Our Options, 33 THE BEHAVIOR ANALYST No. 2 (Fall) 153, 155-160 (2010); USGRCP, Global Climate Change Impacts at 18.
95 L. Thompson, Climate Change: The Evidence and Our Options, 33 THE BEHAVIOR ANALYST No. 2 (Fall) 153, 158 (2010).
96 IPCC, AR4 at 49.
97 See L. Thompson, Climate Change: The Evidence and Our Options, 33 THE BEHAVIOR ANALYST No. 2 (Fall) 153, 164 (2010).
98 See Id. at 155 – 160, 164.
99 EPA, TS Endangerment Findings at 111; USGRCP, Global Climate Change Impacts at 64.
100 EPA, TS Endangerment Findings at 111.
101 L. Thompson, Climate Change: The Evidence and Our Options, 33 THE BEHAVIOR ANALYST No. 2 (Fall) 153, 160 (2010) (“[P]olar ice sheets are slower to respond to temperature rise than the smaller mountain glaciers, but they too, are melting. . . . The loss of ice in the Arctic and Antarctic regions is especially troubling because these are the locations of the largest ice sheets in the world.”).
102 EPA, TS Endangerment Findings at 120; USGCP, Global Climate Change Impacts at 20-21 (“Studies published after the appearance of the IPCC Fourth Assessment Report in 2007 have also found human fingerprints in the increased levels of atmospheric moisture (both close to the surface and over the full extent of the atmosphere), in the
28. Beginning in late 2000, the Jakobshavn Isbrae Glacier (which has a major influence over the mass of the Greenland ice sheet), lost significant amounts of ice. In August of 2010, an enormous iceberg (roughly ninety-seven square miles in size) broke off from Greenland. Nine Antarctic ice shelves have also collapsed into icebergs in the last fifty years, (six of them since 1996). An ice shelf roughly the size of Rhode Island collapsed in 2002, and an ice bridge collapsed in 2009, leaving an ice shelf the size of Jamaica on the verge of shearing off. The 2002 collapse of the Larsen Ice Shelf, which had existed for at least 11,000 years, was “unprecedented in respect to both area and time.”

29. During the 2007-melt season, the extent of Arctic sea ice (frozen ocean water) declined precipitously to its lowest level since satellite measurements began in 1979. By the end of 2010 Arctic sea ice was at the lowest level in the satellite record for the month of December.

30. Arctic sea ice plays an important role in stabilizing the global climate, because it

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103 GARY BRAASCH & BILL MCKIBBEN, EARTH UNDER FIRE 18-20 (2009); See also J.E. Box et. al., (NOAA) Greenland, ARCTIC REPORT CARD at 55 (Oct. 2010) (“A clear pattern of exceptional and record-setting warm air temperatures is evident at long-term meteorological stations around Greenland.”).


108 Id. at 10.

109 National Snow and Ice Data Center (NSDIC), Press Release, Arctic Sea Ice Shatters All Previous Record Lows (October 1, 2007), http://nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html (last visited April 9, 2011); EPA, TS Endangerment Findings at 27 (“Average arctic temperatures increased at almost twice the global average rate in the past 100 years.”).

reflects back in to space much of the solar radiation that the region receives.\footnote{EPA, \textit{Climate Change Indicators in the United States}, 45 (2010), available at \url{http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators_full.pdf} [hereinafter \textit{Climate Change Indicators}]; \textit{See also} EPA, \textit{TS Endangerment Findings} at 40.} In contrast, open ocean water absorbs much more heat from the sun, thus, amplifying human-induced warming and creating an increased global warming effect.\footnote{EPA, \textit{Climate Change Indicators} 52 (2010); USGCRP, \textit{Global Climate Change Impacts} at 39.} As arctic sea ice decreases the region is less capable of stabilizing the global climate and may act as a feedback loop (thereby aggravating global warming).\footnote{EPA, \textit{Climate Change Indicators} 46 (2010).}

31. Scientists have also documented an overall trend of sea-ice thinning.\footnote{NOAA, \textit{State of the Climate in 2009} at S114.} The year 2010 also marked a record-low, spring snow cover in the Arctic since satellite observations first began in 1966.\footnote{NOAA, \textit{Land, ARCTIC REPORT CARD} 29 (Oct. 2010), available at \url{http://www.arctic.noaa.gov/reportcard/ArcticReportCard_full_report.pdf}.} 

32. Similarly, there has been a general increase in permafrost temperatures and permafrost melting in Alaska and other parts of the Arctic (particularly in the last five years).\footnote{Id.} Scientists in Eastern Siberia and Canada have documented substantial methane releases as the permafrost melts.\footnote{NOAA, \textit{State of the Climate in 2009} at S116.} Because much of the Arctic permafrost overlays old peat bogs, scientists believe (and are concerned) that the melting of the permafrost\footnote{USGCRP, \textit{Global Climate Change Impacts} at 139, 142 (“The higher temperatures are already contributing to . . . permafrost warming.”).} may release methane that will further increase global warming to even more dangerous levels.\footnote{\textit{See} IPCC, \textit{4.4.6 Tundra and Arctic/Antarctic Ecosystems}, \textit{Climate Change 2007: Fourth Assessment Report}, Working Group II, \textit{Impacts, Adaptation, and Vulnerability} 231 (2007).} 

33. Changes in these different aspects of Earth’s climate system over the last century tell a coherent story: the impacts we see today are consistent with the scientific understanding of how the climate system should respond to GHG increases from human activities and how the Earth has responded in the past (reflected in such evidence as: ice cores that have trapped air from thousands and even a few million years ago, tree rings and seabed sediments that show where sea level was thousands and even millions of years ago).\footnote{USGCRP, \textit{Global Climate Change Impacts} at 26.} Collectively, these changes cannot be explained as the product of natural climate variability or a tilt in the Earth’s axis
A large human contribution provides the best explanation of observed climate changes.\textsuperscript{122}

34. These well-documented and observable impacts from the changes in Earth’s climate system highlight that the current level of atmospheric CO\textsubscript{2} concentration has already taken the planet into a danger zone.\textsuperscript{123} The Earth will continue to warm in reaction to concentrations of CO\textsubscript{2} from past emissions as well as future emissions.\textsuperscript{124} Warming already in the pipeline is mostly attributable to climate mechanisms that slowly heat the Earth’s climate system in response to atmospheric CO\textsubscript{2}.\textsuperscript{125}

35. The Earth’s oceans play a significant role in keeping our atmospheric climate in the safe-zone.\textsuperscript{126} The oceans constantly absorb CO\textsubscript{2} and release it back into the atmosphere at rates that maintain a balance.\textsuperscript{127} Because we now release so much CO\textsubscript{2}, the oceans have absorbed about one-third of the CO\textsubscript{2} emitted from human activity over the past two centuries.\textsuperscript{128} This capacity has slowed global warming, but at a cost: the added CO\textsubscript{2} has changed the chemistry of the oceans, causing the oceans’ average surface pH (a measurement of hydrogen ions) to drop by an average of .11 units.\textsuperscript{129} Although this may seem relatively small, the pH scale is logarithmic, so that a reduction of only one unit means that the solution has in fact become ten times more acidic.\textsuperscript{130} A drop of .1 pH units means that the concentration of hydrogen ions in seawater has gone up by 30\% in the past two centuries.\textsuperscript{131} If CO\textsubscript{2} levels continue to rise to 500 ppm, we could see a further drop of .3 pH units by 2100.\textsuperscript{132}

36. Ocean acidification harms animals that use calcium to build their shells, as well as

\textsuperscript{121} Id.
\textsuperscript{122} Susan Solomon et al., \textit{Irreversible climate change due to carbon dioxide emissions,} 106 PNAS 1704, 1704 – 1709 (Feb. 10, 2009), \textit{available at} www.pnas.org/cgi/doi/10.1073/pnas.0812721106 (last visited April 9, 2011).
\textsuperscript{123} USGCRP, \textit{Global Climate Change Impacts} at 23.
\textsuperscript{124} EPA, \textit{TS Endangerment Findings} at 26.
\textsuperscript{125} FRED PEARCE, \textit{WITH SPEED AND VIOLENCE: WHY SCIENTISTS FEAR TIPPING POINTS IN CLIMATE CHANGE} 101-104 (Beacon Press 2007); IPCC, \textit{AR4} at 72.
\textsuperscript{126} See EPA, \textit{TS Endangerment Findings} at 16, 38.
\textsuperscript{127} IPCC, \textit{AR4} at 72.
\textsuperscript{128} Inter-Agency Report, \textit{Impacts of Ocean Acidification} at 1; \textit{See also TS Endangerment Findings} at 38 (“[T]he total inorganic carbon content of the oceans increased by 118 ± 19 gigatonnes of carbon (GtC) between 1750 and 1994 and continues to increase.”).
\textsuperscript{129} EPA, \textit{TS Endangerment Findings} at 38; Inter-Agency Report, \textit{Impacts of Ocean Acidification} at 1.
\textsuperscript{130} HARVEY BLATT, \textit{AMERICA’S ENVIRONMENTAL REPORT CARD} 158 (MIT Press 2005).
\textsuperscript{131} A. Ridgwell & D. Schmidt, \textit{Past constraints on the vulnerability of marine calcifiers to massive carbon dioxide release}, 3 \textit{NATURE GEOSCIENCE} 196, 196-200 (2010).
\textsuperscript{132} IPCC, \textit{AR4} at 52.
single-celled organisms that are an essential part of the marine food chain.\textsuperscript{133} This is because the acidified waters affect the structural integrity and survival of shell-building marine organisms such as corals and shellfish by effectively robbing them of the key chemical (carbonate ion) they need to build their skeletons.\textsuperscript{134} It also adversely impacts some kinds of algae and single-celled organisms that use calcification processes for survival.\textsuperscript{135} Some of these organisms comprise magnificent natural features, such as the White Cliffs of Dover.\textsuperscript{136} Coral reefs are major habitats for ocean fauna; and calcifying algae and plankton are key components of the marine food chain.\textsuperscript{137}

37. About 55 million years ago, the ocean absorbed a large amount of CO\textsubscript{2}, likely due to a release of methane from the ocean floor that caused the Earth’s temperatures to rise several degrees and led to the extinction of many species worldwide.\textsuperscript{138} The absorption of so much CO\textsubscript{2} also led to the death of calcifying organisms on the seafloor.\textsuperscript{139} It took over 100,000 years for the ocean to regain its normal alkalinity.\textsuperscript{140} The current of level of CO\textsubscript{2} being taken in by the ocean decreases the ability of coral and other calcium-based marine life to produce their skeletons, which affects the growing of coral and thus coral reefs.\textsuperscript{141} Other marine life, such as algae, also exhibit a reduced growing ability.\textsuperscript{142} Thus, ocean acidification can disrupt the food chain, give non-calcium based creatures a competitive advantage, and limit the geographic reach of calcium based creatures.\textsuperscript{143} In experiments, “[c]oral reef organisms have not demonstrated an ability to adapt to decreasing carbonate saturation state.”\textsuperscript{144} Finally, this disruption to the food web “could substantially alter the biodiversity and productivity of the ocean.”\textsuperscript{145}

\textsuperscript{133} EPA, \textit{TS Endangerment Findings} at 38.
\textsuperscript{134} USGCRP, \textit{Global Climate Change Impacts} at 85.
\textsuperscript{135} \textit{Id}.
\textsuperscript{138} James C. Zachos et al., \textit{Rapid Acidification of the Ocean During the Paleocene-Eocene Thermal Maximum}, 308 \textit{Science} 1611, 1611-1615 (June 10, 2005).
\textsuperscript{139} \textit{Id}.
\textsuperscript{140} \textit{Id}.
\textsuperscript{141} \textit{Id}.
\textsuperscript{142} “[c]oral reef organisms have not demonstrated an ability to adapt to decreasing carbonate saturation state.”\textsuperscript{144}
\textsuperscript{143} \textit{Id}.
\textsuperscript{144} \textit{Id}.
\textsuperscript{145} \textit{Id}.
38. The warming of oceans also contributes to the bleaching of corals.\textsuperscript{146} Corals contain a tiny alga that provides them with food and that accounts for their color.\textsuperscript{147} When the oceans warm, the algae give off toxins, and the corals, in order to survive the toxin, expel the algae, thereby bleaching the coral.\textsuperscript{148} If the water temperature does not fall enough to permit algae to survive within the coral without releasing the toxin, the corals will eventually die.\textsuperscript{149} There have been several severe episodes of coral bleaching in recent years.\textsuperscript{150} With continued warming, the coral may not be able to survive.\textsuperscript{151}

39. Changes in water supply and water quality will also impact agriculture in the US.\textsuperscript{152} Additionally, increased heat and associated issues such as pests, crop diseases, and weather extremes, will all impact crop and livestock production and quality.\textsuperscript{153} For example, climate change in the United States has produced warmer summers, enabling the mountain pine beetle to produce two generations of beetles in a single summer season, where it had previously only been able to produce one; in Alaska, the spruce beetle is maturing in one year when it had previously taken two years.\textsuperscript{154} The expansion of the forest beetle population has killed millions of hectares of trees across the United States and Canada and resulted in millions of dollars lost from decreased timber and tourism revenues.\textsuperscript{155}

40. Agriculture is extremely susceptible to climate changes and higher temperatures generally reduce yields of desirable crops while promoting pest and weed\textsuperscript{156}

\textsuperscript{146} EPA, \textit{TS Endangerment Findings} at 103; USGCRP, \textit{Global Climate Change Impacts} at 148.

\textsuperscript{147} USGCRP, \textit{Global Climate Change Impacts} at 84, 151-52; See EPA, \textit{TS Endangerment Findings} at 138.

\textsuperscript{148} USGCRP, \textit{Global Climate Change Impacts} at 84, 151-52.

\textsuperscript{149} See id.

\textsuperscript{150} Id. at 84.

\textsuperscript{151} Id.


\textsuperscript{153} USDS, \textit{U.S. Climate Action Report} at 87.


\textsuperscript{155} Id.

\textsuperscript{156} USCCSP & USDA, \textit{The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity}, in \textit{Synthesis and Assessment Product 4.3} at 59 ("Many weeds respond more positively to increasing CO\textsubscript{2} than most cash crops, . . .

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Global climate change is predicted to decrease crop yields, increase crop prices, decrease worldwide calorie availability, and by 2050 increase child malnutrition by 20%. Climate change threatens global food security and so any effort to mitigate global warming is effectively promoting a secure food supply.

41. Glacial and ice cap melting is one of the major causes of global sea level change. When glaciers and ice caps melt, this adds water to the ocean. Another cause is that as ocean water warms, it expands and takes up more space; therefore, ocean warming “has been observed in each of the world’s major ocean basins, and has been directly linked to human influences.”

42. Human-caused fossil fuel burning and the resulting climate change are already contributing to an increase in asthma, cancer, cardiovascular disease, stroke, heat-related morbidity and mortality, food-borne diseases, and neurological diseases and disorders. The World Health Organization has concluded, “the health effects of a rapidly changing climate are likely to be overwhelmingly negative”. Climate change is not only expected to affect the basic requirements for maintaining health (clean air and water, sufficient food, and adequate shelter) but is likely to present new challenges for controlling infectious disease and even “halt or reverse the progress that the global public health community is now making against many of these diseases.”

43. As the 2010 Russian summer heat wave graphically demonstrated, heat can

Recent research also suggests that glyphosate, the most widely used herbicide in the United States, loses its efficacy on weeds grown at CO2 levels that likely will occur in the coming decades.


Id. at ix (“Climate change will pose huge challenges to food-security efforts. Hence, any activity that supports agricultural adaptation also enhances food security.”).


USGCRP, *Global Climate Change Impacts* at 18.

Id.


destroy crops, trigger wildfires, exacerbate air pollution, and cause increased illness and deaths. Similar impacts are occurring across the United States: the “number and frequency of forest fires and insect outbreaks are increasing in the interior West, the Southwest, and Alaska. Precipitation, streamflow, and stream temperatures are increasing in most of the continental United States. The western United States is experiencing reduced snowpack and earlier peaks in spring runoff. The growth of many crops and weeds is being stimulated. Migration of plant and animal species is changing the composition and structure of arid, polar, aquatic, coastal, and other ecosystems.” Up to 30% of the millions of species on our planet could go extinct following just a few tenths of a degree warming above present. Large wildﬁres in the Western US have quadrupled in recent years, a result of hotter temperatures and earlier snowmelt that contributes to dryer soils and vegetation.

44. Similarly, climate change is already causing, and will continue to result in, more frequent, extreme, and costly weather events (such as hurricanes). The annual number of major tropical storms and hurricanes has increased over the past 100 years in North America, coinciding with increasing temperatures in the Atlantic sea surface.

45. The changing climate also raises national security concerns, as “climate change will add to tensions even in stable regions of the world.” The United States may experience an additional need to accept immigrant and refugee populations as droughts increase and food production declines in other countries. Increased extreme weather events (such as hurricanes) will also present an increased strain on foreign aid and call for military forces. For instance, by 2025, 40% of the world’s population will be living in countries experiencing significant water shortages, while sea-level rise could cause displacement of tens, or even hundreds,
Paleoclimate data provides sobering evidence that major climate change can occur in decades, and that the consequences would be much more severe, and even disastrous, if a 2°C (3.6°F) change occurs over decades rather than hundreds of years.175

There are at least three reasons that the present, human-induced global warming is particularly significant. First, past global warming and cooling of a similar magnitude occurred before human civilization existed.176 Second, global warming is happening far more rapidly than in past occurrences178, giving both humans and other forms of life only a short time to adapt to the changes. Human civilization and the crops and foods on which it depends have developed within a very narrow set of climatic conditions.179 With the human population so large, with civilization so complex, centered around coastal cities, and dependent on water supplies fed by distant ice and snow melt, and with the great disparities in wealth between and within countries and regions, it will be nearly impossible to adapt to all of the climate change impacts in the quick time-frame in which they will occur.180

Third, and perhaps most importantly, the climate change we are now experiencing is caused largely by human activity.181 This means that unlike with respect to past climate change events, by changing our activities humans can mitigate or even halt

175 Id. at 16.
178 Id.
180 See generally United States Agency International Development (USAID), Adapting to Climate Variability and Change: A Guidance Manual for Development Planning (August 2007) (discussing difficulty of adapting to climate change) http://pdf.usaid.gov/pdf_docs/PNADJ990.pdf; See also USGCRP, Global Climate Change Impacts at 12 (“Climate change will combine with pollution, population growth, overuse of resources, urbanization, and other social, economic, and environmental stresses to create larger impacts than from any of these factors alone.”).
181 See USGCRP, Global Climate Change Impacts at 20; EPA, TS Endangerment Findings 47-51; IPCC, AR4 at 39.
this warming before it causes catastrophic and irreversible effects. Stopping, or at least greatly curtailing, the activities that discharge greenhouse gases into the air, such as the burning of fossil fuels and deforestation, and encouraging activities that remove CO₂ from the atmosphere (such as reforestation), can greatly reduce and even end global warming and its accompanying consequences within the lifetimes of today’s children.

49. To protect Earth’s climate for present and future generations, we must restore Earth’s energy balance. The best available science shows that if the planet once again sends as much energy into space as it absorbs from the sun, this will restore the planet’s climate equilibrium. Scientists have accurately calculated how Earth’s energy balance will change if we reduce long-lived greenhouse gases such as carbon dioxide. Humans have altered Earth’s energy balance and are currently causing a planetary energy imbalance of approximately one-half watt. We would need to reduce atmospheric carbon dioxide concentrations by about 40 ppm, in order to increase Earth’s heat radiation into space by one-half watt, if other long-lived gases stay the same as today. We must reduce atmospheric carbon dioxide concentration to 350 ppm to avoid the threats contained herein.

50. The best available science also shows that to protect Earth’s natural systems,

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182 USGCRP, *Global Climate Change Impacts* at 107 (“By mid-century and beyond, however, today’s emissions choices would generate starkly different climate futures: the lower the emissions, the smaller the climatic changes and resulting impacts.”).

183 See Id. at 12 (“Future climate change and its impacts depend on choices made today.”).


185 James Hansen, *STORMS OF MY GRANDCHILDREN* 166 (2009) (“Also our best current estimate for the planet’s mean energy imbalance over the past decade, thus averaged over the solar cycle, is about +0.5 watt per square meter. Reducing carbon dioxide to 350 ppm would increase emission to space 0.5 watt per square meter, restoring the planet’s energy balance, to first approximation.”).

186 IPCC, *AR4* at 37 (“[T]he global average net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 [+0.6 to +2.4] W/m².”).

187 D.M. Murphy et. al., *An observationally based energy balance for the Earth since 1950* 114 J. GEOPHYSICAL RES. LETTERS D17107 (September 2009).


189 See James E. Hansen et al., *Target Atmospheric CO₂: Where Should Humanity Aim?* 2 OPEN ATMOS. SCI. 217, 217 (2008) (“If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, Paleoclimate evidence and ongoing climate change suggest that CO₂ will need to be reduced from its current 385 ppm to at most 350 ppm.”).
average global surface heating must not exceed 1°C this century. To prevent global heating greater than 1°C, concentrations of atmospheric CO₂ must decline to less than 350 ppm this century. However, today’s atmospheric CO₂ levels are about 390 ppm and are rising.

51. Atmospheric CO₂ levels are currently on a path to reach a climatic tipping point. Absent immediate action to reduce CO₂ emissions, atmospheric CO₂ may reach levels as high as about 1000 ppm and a temperature increase of up to 5°C by 2100. Life on Earth as we know it, is unsustainable at these levels.

52. The Department has the present ability to curtail the environmental harms detailed above. Atmospheric CO₂ concentrations will decrease if people stop (or greatly reduce) their burning of fossil fuels. The environmental harms and threat to human health and safety as described above can only be avoided if atmospheric CO₂ concentrations are immediately reduced. Any more delay risks irreversible and unacceptable consequences for youth and future generations.

53. Fossil fuel emissions must decrease rapidly if atmospheric CO₂ is to be returned to a safe level in this century. Improved forestry and agricultural practices can provide a net drawdown of atmospheric CO₂, primarily via reforestation of degraded lands that are of little or no value for agricultural purposes, returning us

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190 James E. Hansen & Makiko Sato, Paleoclimate Implications for Human-Made Climate Change (January 18, 2011), available at http://www.columbia.edu/~jeh1/mailings/2011/20110118_MilankovicPaper.pdf (last visited April 10, 2011); See also IPCC, AR4 at 48 (“For increases in global average temperature exceeding 1.5 to 2.5°C and in concomitant atmospheric CO₂ concentrations, there are projected to be major changes in ecosystem structure and function, species’ ecological interactions and shifts in species’ geographical ranges, with predominantly negative consequences for biodiversity and ecosystem goods and services, e.g. water and food supply.”).


194 IPCC, AR4 at 66-67.

195 IPCC, AR4 at 46.

196 Harvey Blatt, America’s Environmental Report Card xiii (MIT Press, 2005) (“How can we stop this change in our climate? The answer is clear. Stop burning coal and oil, the sources of nearly all the carbon dioxide increase.”).

to 350 ppm somewhat sooner. However, the potential of these measures is limited. Immediate and substantial reductions in carbon dioxide emissions are required in order to ensure that the youth and future generations of children inherit a planet that is inhabitable.

54. Because most fossil fuel CO$_2$ emissions will remain in the surface carbon reservoirs for millennia, it is imperative that fossil fuel CO$_2$ emissions be rapidly terminated, if atmospheric CO$_2$ is to be returned to a safe level in this century. The failure to act promptly will not only increase the costs of future reductions, it will have irreversible adverse effects on the youth and all future generations, as detailed above.

55. To have the best chance of reducing the concentration of CO$_2$ in the atmosphere to 350 ppm by the end of the century and avoid heating over 1 degree Celsius over pre-industrial temperatures, the best available science concludes that atmospheric carbon dioxide emissions need to peak in 2012 and then begin to decline at a global average of 6% per year between 2013 and 2050 and 5% per year through 2100. In addition, carbon sequestering forests and soils must be preserved and replanted to sequester an additional 100 gigatons of carbon through the end of the century. Waiting until 2020 to reduce carbon dioxide emissions would require annual reductions of at least 15% to return atmospheric concentrations to 350 ppm by 2100.

56. A zero-CO$_2$ U.S. energy system can be achieved within the next thirty to fifty years without acquiring carbon credits from other countries. In other words, actual physical emissions of CO$_2$ from fossil fuels can be eliminated with technologies that are now available or reasonably foreseeable. This can be done at reasonable cost by eliminating fossil fuel subsidies and creating annual and long-term CO$_2$ reduction targets. Net U.S. oil imports can be eliminated in about 25 years, possibly less. The result will also include large ancillary health benefits from the significant reduction of most regional and local air pollution, such as high ozone and particulate levels in cities, which is mainly due to fossil fuel combustion.

57. The approaches to transition to a renewable energy system and to phase out fossil fuels by about 2050 include: A single national cap on fossil fuel use that declines to zero by 2050 or a gradually rising carbon tax with revenues used to promote a

198 Id. at 227.
199 See id. at 211.
200 See James E. Hansen et al., Scientific Case for Avoiding Dangerous Climate Change to Protect Young People and Nature (Jul. 9th, 2012)
http://pubs.giss.nasa.gov/abs/ha08510t.html; See also Amicus Curiae Brief of Dr. James Hansen in Alec L. v. Jackson,*
zero-CO₂ emissions energy system and to mitigate adverse income-distribution effects; increasingly stringent efficiency standards for buildings, appliances, and motor vehicles; elimination of subsidies for fossil fuels, nuclear energy, and biofuels from food crops coupled with investment in a vigorous and diverse research, development and demonstration program (including smart grid and storage technologies, electrification of transportation, stationary fuel cells for combined heat and power, biofuels from aquatic weeds like microalgae, use of aquatic weeds like microalgae in integrated gasification combined cycle plants, and use of hydrogen-fueled passenger aircraft); banning new coal-fired power plants; adoption of a policy that would aim to have essentially carbon-free state, local, and federal governments, including almost all of their buildings and vehicles by 2030; and adoption of a gradually increasing renewable portfolio standard for electricity until it reaches 100 percent by about 2050.\textsuperscript{202}

58. Many of the facts stated in the above paragraphs are also supported by top experts from around the world who have submitted expert testimony to the U.S. District Court in the federal lawsuit \textit{Alec L. v. Jackson}. These expert declarations by the late Dr. Paul Epstein, Ove Hoegh-Guldberg, Sivan Kartha, Pushker Kharecha, David Lobell, Jonathan Overpeck, Camille Parmesan, Stephan Rahmstorf, Steven Running, Kevin Trenberth and Lise Van Susteren are all available at \url{http://ourchildrenstrust.org/page/91/expert-declarations} and such testimony is incorporated herein by reference.

\textbf{B. CLIMATE CHANGE IS ALREADY OCCURRING IN THE STATE OF PENNSYLVANIA AND IS PROJECTED TO SIGNIFICANTLY IMPACT THE STATE IN THE FUTURE.}

59. Since 1970, annual average temperatures in the Northeast region of the United States have increased by 2 degrees (Fahrenheit) in the summer, and by twice as much in the winter. Temperatures are expected to continue warming, with projected additional increases of approximately 3 degrees in the spring and 4 degrees in the summer, fall and winter months by the middle of the current century.\textsuperscript{203}

60. By the end of the current century, without significant world-wide decreases in carbon dioxide emissions, it is projected that summer temperatures in the northeastern U.S. could rise by as much as 6-14 degrees above historic averages, and as much as 8-12 degrees in the winter.\textsuperscript{204}

\textsuperscript{202} See id.
\textsuperscript{204} See Northeast Climate Impacts Synthesis Team, \textit{Confronting Climate Change in the United States: Northeast Science, Impacts and Solutions} (2007); Union of Concerned Scientists.
61. Temperatures in Harrisburg, Pennsylvania have increased 1.2 degrees in the last century, and precipitation has increased as much as 20% in many parts of the state. In the next century, it is predicted that temperature at this location will increase a further 4 degrees, with seasonal increases in precipitation between 10-50%.205

62. An increase in frequency of summer temperatures exceeding “extreme heat” (conditions of over 90 degrees) is expected as a result of continued climate change. By the year 2050, it is estimated that southern and eastern Pennsylvania will receive as many as 50 days per year exceeding 90 degrees, and as many as 70 days per year by the end of the century.206

63. The number of days below 32 degrees (freezing) is expected to decrease by half in the next several decades, and disappear in all but the highest altitudes of Pennsylvania by the end of the current century.207

64. It is predicted that warming will lead to an increased growing season in the northeast United States. This resulting lengthening will cause spring to begin three weeks earlier and winter to arrive three weeks later by the end of the current century.208

65. Precipitation has increased by 10% in the last century, and further increases in

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207 See Union of Concerned Scientists, Climate Change in Pennsylvania: Impacts and Solutions in the Keystone State (2008); Center for Health and the Global Environment, Harvard Medical School, Climate Change and Health in Pennsylvania (2011).

precipitation by an additional 10-30% are expected within the next century.\textsuperscript{209}

66. As average winter temperatures increase, more precipitation will fall in the form of rain instead of snow, which will reduce snowpack and increase the likelihood of flooding during the winter and spring months.\textsuperscript{210}

67. In general, the amount of rainfall received during extremely wet days of the summer and fall months is expected to increase. It is also expected that an increase in the frequency and intensity of summer thunderstorms may occur.\textsuperscript{211}

68. Increases in winter and spring precipitation (combined with the early melting of snowpack) are expected to shift the timing of peak surface water flows earlier in the spring and cause low-flows in the late summer and early fall. This is of special concern for the tributaries to the Ohio River, where peak flows in the spring are expected to arrive several weeks earlier with a 4-degree increase in average annual temperature.\textsuperscript{212}

69. Climate change and winter warming are correlated with the earlier break-up of ice on lakes and rivers, which increases the influx of early spring waters into surface flows.\textsuperscript{213}

70. Groundwater recharge could be adversely affected by declines in groundwater

supply during the late summer and early fall. Precipitation events during these months are expected to be intense, but with greater length of time between events.\textsuperscript{214}

71. Some of the most extreme flood events on record in the United States occurred in Pennsylvania. Increases in winter and spring runoff are expected to increase the incidence of flooding. Flood events may also increase the amount of pollution, erosion, and nutrient inputs moving from urban, agricultural, and industrial lands, into wetland ecosystems.\textsuperscript{215}

72. Warmer ambient temperatures will warm surface and groundwater supplies, potentially compromising the quality of these resources.\textsuperscript{216}

73. The increased frequency and intensity of flooding, drought, wildfires and invasion of non-native plant species are all anticipated to cause, and accelerate, a rapid transformation of Pennsylvania’s current landscape and its ecosystems.\textsuperscript{217}

74. A significant increase in summer drying is expected to change tree species composition in forested regions of the State and lead to an overall decrease in forested land. With warmer conditions, it is also expected that forested lands will shift northward, and grasslands and pasture will replace many forested areas. A 15-20\% overall loss of forestlands is projected.\textsuperscript{218}


75. A change in climate has the ability to increase the occurrence of wildfires by increasing drought conditions, increasing insect pest and disease pressure with a longer growing season, and also cause tree-community shifts to accommodate more fire-prone species. Increased wildfire events will increase the rate at which invasive plant species will be able to encroach on forested lands.\textsuperscript{219}

76. Initial increases in forest growth may be observed in response to elevated levels of atmospheric CO\textsubscript{2}, but within a short amount of time forests will begin to be adversely affected by high amounts of ground-level ozone. Ground-level ozone is damaging to trees and plants.\textsuperscript{220}

77. With forest habitat losses, it is expected that the area’s Bald Eagles will also face decline, as they migrate north with shifting climate patterns and resources. This event is predicted to coincide with a 25\% overall decline in the biodiversity of bird species.\textsuperscript{221}

78. The Pocono Mountains and the Two Mile Run wetlands in Pennsylvania are home to many rare and valuable species of trees and wildlife, as well as several acres of public wilderness. The flora and fauna could have difficulty adapting to climate change, and with only a few corridors allowing for migration, it is possible that there could be a significant reduction in biodiversity, causing local extinctions.\textsuperscript{222}

79. With lengthened growing seasons and warmer temperatures, the growth, reproductive capability, and geographical range of forest insect pests, such as the Hemlock Woolly Adelgid, will all be increased.\textsuperscript{223}


\textsuperscript{223} See Northeast Climate Impacts Synthesis Team, \textit{Confronting Climate Change in the United States: Northeast Science, Impacts and Solutions} (2007); Pennsylvania
80. The Erie National Wildlife Refuge provides aquatic resources vital to the preservation of approximately 70 species of fish and 25 species of freshwater mussels, many of which are already endangered. Further pressure to this ecosystem from climate change puts the aquatic wildlife at increased risk for extirpation. 224

81. Brook trout and other coldwater fish are expected to decline in population due to warmer water temperatures in the rivers and lakes of Pennsylvania. 225

82. Invasive plant and wildlife species better adapted to hotter and drier conditions (like those predicted by climate change models) have a higher chance of successfully overtaking native species (which are expected to experience decreases in geographic range due to stress from climate change). These stresses include seasonal drying of wetland habitat, increase in the frequency and severity of extreme weather events, and changes in atmospheric chemical composition. 226

83. Heat waves are predicted to become much more common, which will pose increased risks to human health. An increase in average temperatures is expected to increase the number of heat-related illnesses and deaths, especially in cities. One study has predicted that the number of heat related deaths could increase by as much as 90% by the year 2050, increasing from 130 per year to over 240. 227

84. Increase in flooding is of high concern, as the increase in the frequency and magnitude of flooding events will increase the incidence of related morbidity and mortality. 228


228 See Pennsylvania Department of Environmental Protection, *Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations* (2011); The Center
85. Increased emissions combined with higher temperatures will cause an increase in levels of ground-level ozone. Ozone is a toxic component of smog with the potential to cause serious long-term and permanent damage to lung tissues with repeat exposure. A 4-degree increase in average temperature near Pittsburg could increase concentration of ground-level ozone by 8%.\(^{229}\)

86. Increases in temperature and humidity levels (thought to increase mold) can aggravate symptoms of respiratory allergies and asthma by stimulating plant pollen production. This problem will be further exacerbated by high availability of atmospheric CO\(_2\), which is also predicted to stimulate plant growth early in the season.\(^{230}\)

87. Due to “Island Heat” effects in urban areas, the effects of climate change will be much more extreme in cities, which may be as much as 7-10 degrees warmer than surrounding suburban areas.\(^{231}\)

88. With milder, shorter winters and longer growing seasons, insects and other disease vectors are expected to increase. Risk of increase in West Nile Virus, malaria, and dengue transmission are all of special concern.\(^{232}\)

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89. Many waterborne diseases (such as cholera) thrive in warm water conditions, and will present an increased risk to public health as temperatures and flood frequency both increase. There is also increased risk of sewage and septic system overflows during times of flooding.\(^\text{233}\)

90. Warmer temperatures and increased seasonal precipitation could increase low-lying vegetation. This may lead to an increase in the population of ticks (and their rodent hosts) possibly carrying Lyme’s and other tick-borne diseases.\(^\text{234}\)

91. Changes to forest tree species include shifts from the current maple-dominated community composition to a community dominated by species better adapted to warmer climates, such as pines and oak. The additional risk from more frequent and severe forest fires will increase as the region experiences a hotter and drier climate. An overall loss of forested lands between 15-25% is projected by the end of the current century.\(^\text{235}\)

92. Climate changes and a shift in plant and animal communities will lead to a loss of wildlife and habitat. This reality threatens the $181 million annual industry that is received by the state in the form of hunting, fishing, and wildlife-viewing tourism.\(^\text{236}\)

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\(^{236}\) See The Center for Integrative Environmental Research, University of Maryland, *Economic Impacts of Climate Change on Pennsylvania* (2008).
93. Agricultural crop yields are heavily reliant on temperature, moisture and day-to-day weather. They are also especially vulnerable to climate change. Major, regional shifts are expected to occur and it will be difficult to maintain current production rates, and quality, of food commodities. It is predicted that crop production will shift northward, which will make adaptation for farmers difficult.\textsuperscript{237}

94. Initial increases in forest and crop growth may be observed in response to elevated levels of atmospheric CO\textsubscript{2}, but within a short amount of time plants will begin to be adversely affected by high amounts of ground-level ozone. Ground-level ozone is damaging to trees and plants.\textsuperscript{238}

95. Milder winters increase the likelihood that weeds (such as kudzu), pests, and pathogens, previously unable to survive New England’s lower temperatures will be able to successfully invade. This will lead to increased costs for pest control and is likely to result in other costly damages.\textsuperscript{239}

96. Overall crop yield for hay and corn is expected to decrease by as much as 39\% by the year 2100, leading to large changes in the number of acres farmed and the subsequent production rates.\textsuperscript{240}

97. As winters become milder, the number of freezing days available for certain crops (such as Concord grapes) will be more infrequent, with an estimated projection of harvests only every other year by 2050, and only 3 out of every 5 years by the end of the century. Apple orchards will also decline in yield with decreased winter freezing.\textsuperscript{241}

98. Livestock production is expected to decline as the cost of feed and ventilation for indoor animals increases, and as decreased crop production is expected to limit forage resources. Increased temperatures may also cause direct stress to animals, causing decreases in growth and a projected 20\% or more decrease in milk

\textsuperscript{237} See USGCRP, Global Climate Change Impacts on the United States: Regional Climate Impacts on the Northeast (Washington D.C., 2000).
\textsuperscript{238} See id.
\textsuperscript{239} See Northeast Climate Impacts Synthesis Team, Confronting Climate Change in the United States: Northeast Science, Impacts and Solutions (2007).
\textsuperscript{241} See Union of Concerned Scientists, Climate Change in Pennsylvania: Impacts and Solutions in the Keystone State (2008).
99. Increasing precipitation received during downpours is expected to increase flooding, increase damages to infrastructure, and cause human health problems. This is especially so in cities, where heavy rains can overwhelm drainage systems and water treatment facilities, increasing the likelihood of waterborne diseases and therefore increasing associated heath care costs.  

100. Increased flooding poses a serious risk to transportation agencies. More frequent and severe storm events coupled with flooding and structural failures resulting from high-heat conditions are expected to cause damage to roadways, bridges, railways, and other utility systems.

101. Decreased water levels could cause several economic issues for all of the states bordering the Great Lakes. Low water levels lead to a decrease in depth of navigation channels and will cause damage to vessels and increase repair expenses, as well as require the rebuilding of docks and harbors. These transformations are expected to require between $85 and $142 million dollars annually.

102. If the Commonwealth of Pennsylvania had begun reducing carbon emissions in 2005, it would have done its part by protecting a stable livable atmosphere by 2100 with only a 3% annual reduction in emissions. Because we have waited, reaching a

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245 See The Center for Integrative Environmental Research, University of Maryland, Economic Impacts of Climate Change on Pennsylvania (2008).
safe atmosphere by the end of the century will require a 6% annual reduction in emissions beginning in 2013. If we delay until 2020 to reduce our greenhouse gas emissions we would have to reduce emissions by 15% every year until the end of this century to ensure a livable atmosphere for our generation and the next.\textsuperscript{246}

\textbf{C. THE PUBLIC TRUST DOCTRINE Demands that the State of Pennsylvania Act to Preserve the Atmosphere and Provide a Livable Future for Present and Future Generations of Pennsylvanians.}

103. The citizens of Pennsylvania, including Petitioners, have a right to a healthy atmosphere and stable climate.

104. Article I, section 27 of the Pennsylvania Constitution provides as follows:

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“Sec. 27. Natural Resources and the Public Estate
The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people.”
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105. This amendment (Sec. 27), which was adopted in 1971, encompasses two basic principles. First, Pennsylvanians have a right to a healthy environment, and second, the sovereign government of Pennsylvania has a trusteeship responsibility to protect that environment on behalf of future generations.\textsuperscript{247}

106. The statute that creates the Department of Conservation and Natural Resources, as well as the statutes that the Department is charged with administering, implement this amendment.\textsuperscript{248}

107. A court in the State of Texas recently held that pursuant to the Texas Constitution, all natural resources, including the air and atmosphere, are trust assets and must be protected by the state.\textsuperscript{249} Similarly, a New Mexico court has recently denied a

\textsuperscript{246} James E. Hansen et al., \textit{Scientific Case for Avoiding Dangerous Climate Change to Protect Young People and Nature} (Jul. 9\textsuperscript{th}, 2012) http://pubs.giss.nasa.gov/abs/ha08510t.html. (“these scenarios assume a massive 100 GtC reforestation program”).


\textsuperscript{248} http://www.dcnr.state.pa.us/legal/constitution.htm

motion to dismiss a suit against the governor and the state for violating its public trust duties to protect the atmosphere. That case will be proceeding on the merits to determine if the state has complied with its trust duties to protect the atmosphere when repealing regulations that address greenhouse gas emissions.\footnote{http://ourchildrenstrust.org/sites/default/files/Order%20Denying%20Motion%20to%20Dismiss.pdf}

108. There is no greater duty of parents than to provide for the protection and safety of their children. Likewise, there is no greater duty of our government than to ensure the protection and safety of its citizens, both born and yet to be born. As described above, the Earth’s atmosphere is what has allowed humans to exist and flourish on this planet. But human activity has allowed the atmospheric equilibrium to become imbalanced, and now human life on Earth is in grave danger.

109. The atmosphere, essential to human existence, is an asset that belongs to all people. The public trust doctrine requires that as a trustee, the State of Pennsylvania and the Governor, through the Environmental Quality Board, its Department of Environmental Protection, its Department of Conservation, its Natural Resources, and its Department of Transportation, hold vital natural resources in \textit{trust}, for both present and future generations of its citizens. These resources are so vital to the well-being of all people, including the citizens of Pennsylvania, that they must be protected by this distinctive, long- standing judicial principle. The atmosphere, including the air, is one of the most crucial assets of our public trust.

110. The public trust doctrine holds government responsible, as perpetual trustee, for the protection and preservation of the atmosphere for the benefit of both present and future generations. Today the citizens of Pennsylvania are confronted with an atmospheric emergency. No case ever decided by the courts of Pennsylvania under the state Constitution, section 27, have been faced with a threat of such enormity to public resources. Thus, it is incumbent upon the Department to uphold its public trust obligation to the people of Pennsylvania and initiate rulemaking in accordance with this petition.

111. If the Department, as trustees of the atmosphere (an essential and fundamental resource that belongs to all citizens of Pennsylvania), does not take immediate and extraordinary action to protect, preserve, and bring the Earth’s atmosphere back into balance, then children in Pennsylvania and countless future generations of children will suffer continually greater injuries and damaging consequences. If we, as a society, want to protect and keep the world safe for our children, including here in the great State of Pennsylvania, then the Department must immediately accept its fiduciary responsibility as mandated by its trustee obligation and adopt the rule proposed herein.

112. The public trust imposes a legal obligation on the Department to affirmatively
preserve and protect the citizen’s trust assets from damage or loss, and not to use the asset in a manner that causes injury to the trust beneficiaries, be they present or future. The sovereign trustee has an affirmative, fiduciary duty to prevent waste, to use reasonable skill and care to preserve the trust property, and to maintain trust assets. The duty to protect the trust asset means that the Department must ensure the continued availability and existence of healthy trust resources for present and future beneficiaries. This duty mandates the development and utilization of the trust resource in a manner consistent with its conservation and in furtherance of the self-sufficiency of the State.

113. Pennsylvania’s fiduciary duty in this instance is defined by scientists’ concrete prescriptions for carbon reductions. Scientists have clearly expressed the minimum carbon dioxide reductions that are needed, and requisite timelines for their implementation. Pennsylvania may not disclaim this fiduciary obligation, and is subject to an ongoing mandatory duty to preserve and protect this atmospheric trust asset.

114. The children in the State of Pennsylvania are already experiencing serious environmental, economic, physical, emotional and aesthetic injuries as a result of the State government’s actions and inactions. If Pennsylvania fails to regulate and continues to contribute to this atmospheric crisis, then these injuries will only intensify and expand. A failure to immediately take bold action to protect and preserve Earth’s safe climate-zone will cause irreparable harm to the citizens of Pennsylvania and others. Immediate state action is imperative.

115. Once certain tipping points of energy imbalance and planetary heating have been exceeded, we will not be able to prevent the ensuing harm. A failure to act soon may cause the collapse of the Earth’s natural systems resulting in a planet that is largely unfit for human life. The responsibility to protect and preserve the atmosphere for the citizens of Pennsylvania is the duty of the Department. This mandate requires the Department to protect and preserve that which belongs to all of its citizens and not to allow uses of those assets in a way that causes injury and damage to its citizen beneficiaries.

116. If sovereign governments, including the Department, do not immediately react to this crisis and act swiftly to reduce carbon dioxide emissions being released into the atmosphere, the environment in which humans and other life on Earth has thrived, will no longer exist. If Pennsylvania does not act immediately to reduce carbon dioxide emissions into the atmosphere, the youth of Pennsylvania and future generations of the State’s children will face a planet that may be largely uninhabitable.

117. Pennsylvania must protect and preserve the planet for its children and future generations. The United States, and the State of Pennsylvania, must lead the way and reduce its carbon dioxide emissions. The United States, including Pennsylvania, not only has a large responsibility for currently harming the
atmosphere, but it has the capacity and the technology to reduce emissions, as well as the will and obligation to protect its citizens. The rest of the world is looking to the United States to lead this effort. Without Pennsylvania’s action the catastrophic collapse of natural systems is inevitable.

118. The shared atmosphere is a natural resource vital to human health, welfare, and survival. Atmospheric health is essential to all survival. Our atmosphere is a fundamental natural resource entrusted to the care of our governments, and the State of Pennsylvania, in trust, for its preservation and protection as a common property interest. As a co-tenant trustee of this shared asset, the Department has a fiduciary, and perpetual, affirmative duty to preserve and protect the atmosphere for the present citizens and future generations of Pennsylvania, as beneficiaries of this trust asset.

D. Persons, Businesses or Entities Affected

119. Pursuant to Pa. Code 23.1(a)(4), Petitioner believes that virtually every citizen and business in the Commonwealth would be affected by the proposed regulation. They can be classified into those whose conduct could be subject to the regulations and those that will benefit from the results produced by the regulatory regime. Persons Affected Because Their Conduct Could Be Subject To The Regulations: Because the goal of the regulation is to reduce fossil fuel carbon dioxide emissions, any person or entity that emits CO$_2$ could potentially be subject to regulatory actions designed to reduce those emissions. However, Petitioner believes that the most effective way to achieve the reductions necessary for safe atmospheric concentrations of CO$_2$ is to focus the regulatory reduction efforts on large sources of CO$_2$ including the energy sector, transportation, efficiency and conservation. Thus, the most likely affected sources would be electricity generating plants and large and medium industrial consumers of fossil fuels. However, depending upon the final form of the regulations, small users of fossil fuels, such as residential and transportation users, might find that the regulations will impact their actions. Persons Affected Because They Will Benefit From The Regulations: Every citizen and business in the Commonwealth stands to benefit from the proposed regulatory regime. As CO$_2$ concentrations decrease to safe levels, all such citizens and businesses will enjoy a world with fewer damaging and dangerous effects of climate disruption. Citizens of the Commonwealth will suffer fewer adverse health effects, and less property damage from storms, flooding, and other natural disasters caused by climate change. Farmers in the Commonwealth will suffer less property damage from storms, flooding, drought, and other natural disasters. Businesses will suffer fewer losses and lost profits caused by climate change. And many jobs will be created in order to support the transition away from fossil fuel consumption to a clean energy economy.

And so, for the reasons above, it is with utmost respect that petitioner Ashley
Funk hereby submits this petition on behalf of herself, the citizens of the State of Pennsylvania, and present and future generations of minor children in Pennsylvania. The petitioner respectfully requests that the EQB (in order to fulfill the Commonwealth’s fiduciary duties) promulgate a rule that requires the Department to take the necessary steps (outlined herein) to protect the integrity of Earth’s climate by adequately protecting our atmosphere, a public trust resource upon which all Pennsylvanians rely for their health, safety, sustenance, and security.

Petitioner also respectfully requests a public hearing on this rulemaking petition, and the opportunity to meet with and present their petition to Department staff and the Board. Should the petition be denied, Petitioners request a written decision explaining how the Department is complying with its Constitutional, public trust obligation to protect the atmospheric resource and what level of protection it believes is necessary to protect the people of the State of Pennsylvania.

Respectfully submitted,

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APPENDIX I – SUGGESTED REGULATORY LANGUAGE

1. **Regulatory Goal.** In accordance with 35 P.S. § 4004(18), the Department shall prepare and develop a comprehensive plan for the control and abatement of carbon dioxide emissions that will specifically achieve the following:

   (a) Carbon dioxide emissions from fossil fuels in the Commonwealth of Pennsylvania will peak no later than 2013 as determined by the Baseline CO₂ Emission Rate; and

   (b) Starting in 2013, annual fossil fuel carbon dioxide emissions in the Commonwealth will be reduced by at least 6% per year as determined by the previous year’s Annual CO₂ Emission Rate through the year 2050.

2. **Baseline Emission Rate.** In connection with its work required by 71 P.S. § 1361.4 (the Pennsylvania Climate Change Act, Act 70), the Department shall determine the amount of carbon dioxide emitted in 2012 from all fossil fuel burning sources in the Commonwealth. This amount shall be the Baseline CO₂ Emission Rate for purposes of this regulation.

3. **Determination of Annual CO₂ Emission Rate.** The Department shall undertake such actions as are necessary to determine the amount of carbon dioxide emitted each year from all fossil fuel burning sources in the Commonwealth. This amount shall be the Annual CO₂ Emission Rate for that given year.

4. **Reductions in Annual CO₂ Emission Rate.** The Department shall undertake such actions as are necessary to achieve at least a 6% reduction in the Annual CO₂ Emission Rate from the Baseline CO₂ Emission Rate by the end of 2013, and then at least a 6% reduction in the Annual CO₂ Emission Rate each year compared to the Annual CO₂ Emission Rate of the previous year, through the year 2050.

   (a) The Department shall have such powers as necessary to achieve the annual 6% reduction in Annual CO₂ Emission Rate, including the powers to create permit provisions, conditions, enforceable agreements with emission sources, as well as the power to enforce, through administrative or judicial means, any reductions imposed on or agreed to by a source of carbon dioxide emissions.

   (b) The Department shall certify the rate of reduction of the Annual CO₂ Emission Rate each year and make the information used in determining the reduction in that Rate publicly available. The information made available to the public shall include the data compiled by individual source, source categories, and the methodology used by the Department to compile both any components of as well as the total reduction in the Annual CO₂ Emission Rate.

   (c) If the Department determines that the rate of reduction for a particular year does not meet the required 6% reduction, the Department shall announce and undertake such further actions, including the imposition of greater reductions in emissions of carbon dioxide, so that the total reductions in carbon dioxide emissions will return to the rate
imposed by this regulation within 12 months.

5. To the extent that any rule in this section conflicts with any other rule in effect, the more stringent rule, favoring full disclosure of emissions and protection of the atmosphere, governs.