

**IN THE SUPERIOR COURT OF THE STATE OF WASHINGTON
IN AND FOR THE COUNTY OF KING**

ZOE & STELLA FOSTER, minor children by and through their guardians MICHAEL FOSTER and MALINDA BAILEY; AJI & ADONIS PIPER, minor children by and through their guardian HELAINA PIPER; WREN WAGENBACH, a minor child by and through her guardian MIKE WAGENBACH; LARA FAIN, a minor child by and through her guardian MONIQUE DINH; GABRIEL MANDELL, a minor child by and through his guardians VALERIE and RANDY MANDELL; JENNY XU, a minor child by and through her guardians YAN ZHANG & WENFENG XU,

Petitioners,

v.

WASHINGTON DEPARTMENT OF
ECOLOGY,

Respondent.

No. 14-2-25295-1 SEA

**DECLARATION OF PUSHKER
KHARECHA, PHD, IN SUPPORT
OF PETITIONERS' OPENING
BRIEF**

1 I, Pushker Kharecha, Ph.D., declare as follows:

2 1. I make this declaration in support of Petitioners in the above captioned case.

3 2. I am a U.S. citizen and a climate scientist at the Columbia University Earth Institute in
4 New York City, also affiliated with the NASA Goddard Institute for Space Studies (GISS).

5 My primary area of research is the interrelationship between the global climate and carbon
6 cycle. This involves studying the exchange of carbon in its various forms (carbon dioxide,
7 organic carbon in soils and vegetation, etc.) among the different components of the Earth's
8 climate system (air, land, and sea), and the effects of climate change on these processes (and
9 vice-versa). My work involves the use of various types of measurements as well as simple
10 and complex computer models. I have lead/co-authored scholarly and popular science
11 publications on topics related to both the drivers of human-induced global climate change
12 (fossil fuel and land use) as well as potential solutions to the climate problem (e.g.,
13 alternative energy). As described in my CV (attached), I have given numerous invited talks
14 on these topics to scientists as well as lay audiences. I have also served as an invited reviewer
15 and co-lead author on two United Nations Environment Programme publications. Recently, I
16 have also been closely involved with various efforts of the United Nations Sustainable
17 Development Solutions Network. In much of my work I collaborate with Dr. James Hansen,
18 former director of NASA GISS and one of the world's foremost climate scientists.

19 3. In recent years, my research has focused on the danger of passing climate tipping
20 points that would yield a different planet from the one on which civilization developed. As
21 part of my work, Dr. Hansen and I, along with other leading climate scientists and experts,
22 have outlined steps that are needed to stabilize climate, with a cleaner atmosphere and ocean.
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1 4. I am a co-author with Dr. Hansen on the peer-reviewed scientific publication,
2 *Assessing 'Dangerous Climate Change': Required Reduction of Carbon Emissions to Protect*
3 *Young People, Future Generations and Nature.*¹ In this paper, we use Earth's measured
4 energy imbalance, paleoclimate data, and simple representations of the global carbon cycle
5 and temperature to define emission reductions needed to stabilize climate and avoid
6 potentially disastrous and irreversible impacts on today's young people, future generations,
7 and nature.

9 5. Current scientific understanding is clear that human burning of fossil fuels has
10 disrupted Earth's energy balance, and in response the planet is heating up – with no end in
11 sight, unless we alter our present path. Atmospheric carbon dioxide (CO₂) concentrations,
12 for example, are now at their highest level in 3 million years, and global surface temperatures
13 now have reached the prior maximum of the Holocene era, the period of relatively moderate
14 climate that, over the last 10,000 years, has enabled civilization to develop.

16 6. We are observing impacts of the relatively small amount of warming that has already
17 occurred, and these constitute harbingers of far more dangerous change to come. If
18 unabated, continued carbon emissions will initiate dynamic climate change and effects that
19 spin out of control of future generations as the planet's energy imbalance triggers amplifying
20 feedbacks and the climate system and biological system pass critical tipping points. Unless
21 arrested by effective and immediate action, climate change will produce calamitous
22 consequences for humanity and nature alike, as tipping points are reached and points of no
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25 ¹ James Hansen, *et al.*, *Assessing 'Dangerous Climate Change': Required Reduction of Carbon Emissions to*
26 *Protect Young People, Future Generations and Nature*, PLOS ONE 8:12, e81628 (2013) [*Assessing 'Dangerous*
Climate Change'], available at
<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0081648>.

1 return are crossed. What sovereign governments do today to reduce carbon pollution matters
2 immensely.

3 7. Paleoclimate research Dr. Hansen and I have conducted establishes that for most of the
4 Holocene period – the period of the most recent 10,000 years – the Earth’s climate, though
5 highly variable on a regional basis, has been characterized by reasonably constant mean
6 global temperatures. This constancy enabled the Greenland and Antarctic ice sheets to
7 remain in near mass balance, sea levels to be relatively stable, species to diversify, and
8 civilization to develop.² Maintaining a climate that resembles the Holocene epoch, the world
9 of a relatively stable climate system under which civilization developed, requires rapid
10 reduction of fossil fuel CO₂ emissions and major improvements in land use practices, such as
11 massive reforestation.
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13 8. The present CO₂ concentration in the atmosphere, approximately 399 parts per million
14 (ppm), is at a level not seen on Earth for at least 3 million years. The best available current
15 science establishes that today’s CO₂ level and global mean temperature are already close to
16 or into the dangerous zone, and there is more heat already in the pipeline due to the time lag
17 between increasing CO₂ levels and global temperature response.
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19 9. Atmospheric CO₂ concentrations passed the level that is estimated to be safe in the
20 long term (350 ppm) in approximately 1988.³ Global mean temperatures now exceed the
21 Holocene peak and unabated fossil fuel emissions continue to drive the Earth increasingly
22 out of energy balance.
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25 ² For a more thorough discussion of this process, see Hansen, *et al.*, *Assessing ‘Dangerous Climate Change.’*

26 ³ James Hansen, *et al.*, *Target atmospheric CO₂: Where should humanity aim?* 2 *Open Atmos. Sci. J.* 217-231 (2008), available at http://pubs.giss.nasa.gov/docs/2008/2008_Hansen_etal_1.pdf.

1 10. Unless action is undertaken without further delay to return the atmospheric
2 concentration of CO₂ to 350 ppm by 2100, Earth's climate system will be pressed toward and
3 past points of no return, with ever-worsening climate-related impacts in the meantime.

4 Effective action remains possible, but delay in undertaking sharp reductions in emissions will
5 undermine any realistic chance of achieving climate stabilization and preserving a habitable
6 climate system.

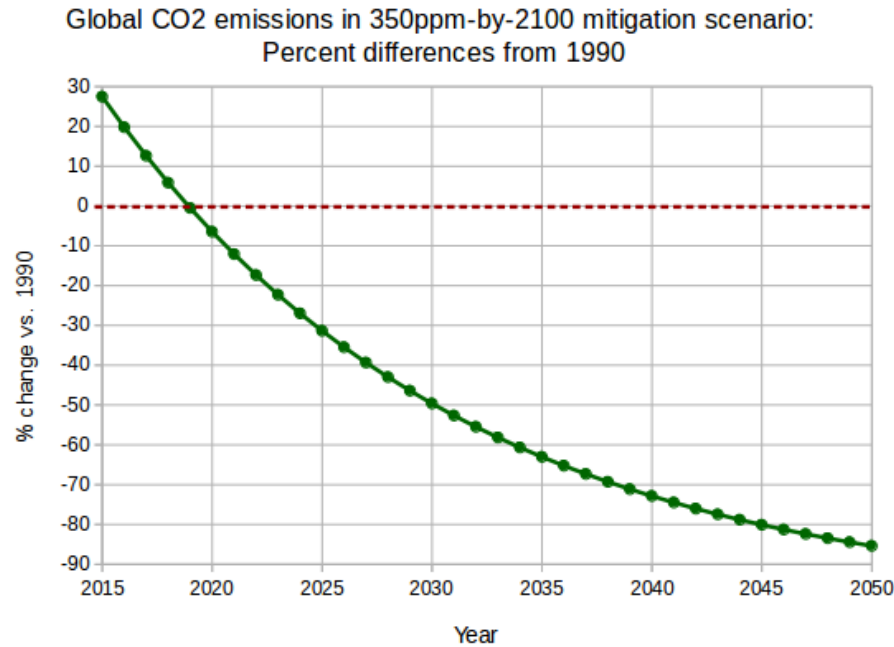
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8 11. I consulted with Youth Petitioners in June 2014 regarding the best method of
9 calculating the required annual rate of carbon dioxide (CO₂) emission reductions for the State
10 of Washington to put the State on a pathway toward climate stability. I confirmed that based
11 on the best available current science, with a peak year of 2007, CO₂ emissions in Washington
12 must be reduced by at least 4% per year in order to be in line with a global trajectory of
13 achieving climate stabilization and returning atmospheric CO₂ concentrations to
14 approximately 350 ppm by the end of the century.

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16 12. I have reviewed the Washington Department of Ecology's (Ecology's) report,
17 *Washington Greenhouse Gas Emission Reduction Limits: Report prepared under RCW*
18 *70.235.040*, Publication no. 14-01-006 (Dec. 2014) (Ecology Report). Based on the existing
19 state greenhouse gas emission limits, quantified on page 1 of Ecology's report, it is my
20 professional opinion that Washington's targets at RCW 70.235, fall significantly short of the
21 current scientific understanding of what is minimally needed for Washington to "do its part
22 to reach global climate stabilization levels." Specifically, in our mitigation scenario that
23 reaches 350 ppm CO₂ by ca. 2100⁴, global CO₂ emissions in 2020, 2035, and 2050 (the
24 benchmark years in RCW 70.235) are about 6%, 60%, and 85% lower than the 1990 value,
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26 ⁴ Hansen, *et al.*, *Assessing 'Dangerous Climate Change.'*

1 respectively. The corresponding values in RCW 70.235 are 0%, 25%, and 50%, respectively.

2 See graph below.



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15 13. By contrast, Petitioners’ proposed rule is consistent with the current best available

16 scientific understanding of what is minimally needed to avert truly dangerous climate change

17 and to preserve the physical status quo of a habitable climate system for future generations.

18 14. While Ecology agrees that Washington State’s existing statutory limits “need to be

19 more aggressive” for Washington to do its part to stabilize the global climate and “should be

20 adjusted to better reflect current science,” Ecology does not present the current science on

21 climate stabilization, even though that science exists, is available and apparently known to

22 Ecology. Instead, Ecology calls for further delay by recommending that “no changes be

23 made to the state’s statutory emission limits.” Ecology Report at vi. Further delay of

24 meaningful action to address climate change vastly increases the risk of irreversible damage

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1 to the climate system and is not consistent with current scientific understanding that
2 immediate action is needed.

3 15. A fundamental problem in Ecology’s analysis is that it correlates “climate
4 stabilization” with “keeping the global carbon dioxide concentrations in the atmosphere
5 below certain values”, yet it does not specify those values or the time frame in which to
6 achieve them. Ecology Report at 4. My colleagues and I assess that there are several key
7 reasons to reduce CO₂ concentrations to 350 ppm by around the end of this century. First, the
8 human-caused atmospheric CO₂ increase over the Industrial era (from 280 ppm to 399 ppm)
9 represents the single largest driving factor of global climate change over the last 50+ years.
10 Second, a substantial share of any additional infusion of CO₂ remains in the atmosphere for
11 millennia (and while there, continuously acts to further heat the planet). Accordingly, Earth’s
12 temperature response to the enhanced greenhouse effect of the higher atmospheric CO₂
13 concentration is a function of not only recent emissions but the persisting share of prior
14 emissions. Third, as a consequence of the long-lived nature of CO₂ and the fact that human-
15 derived emissions have already caused a substantial overshoot of the long-term safe
16 atmospheric concentration, any substantial delay in undertaking effective action would
17 render it effectively impossible to return the atmospheric CO₂ concentration to 350 ppm
18 within this century.

19 16. In its report, Ecology suggests that the 2°C target above pre-industrial temperatures,
20 which approximately equates to an atmospheric CO₂ concentration of 450 ppm, may not
21 reflect the current science of climate stabilization. Ecology Report at 17. The agency is
22 correct. In fact, the 2°C target originated from a decision by the European Union in 1996,
23 almost twenty years ago. However, our scientific understanding has advanced significantly
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1 in the last two decades, as have the climate impacts already facing our natural and human
2 systems, with only 0.8°C of warming. The scientific community has consistently
3 underestimated the impacts associated with atmospheric CO₂ levels and the resulting
4 planetary heating. The 2°C target cannot be considered a safe target for present or future
5 generations, and is not supported by current science.

7 17. Earth’s paleoclimate history demonstrates that climate impacts accompanying global
8 warming of 2°C or more would be highly deleterious. The impacts of ongoing global
9 warming are numerous and increasing, many more rapid than anticipated and occurring while
10 global warming is less than 1°C. The warming of the past few decades has brought global
11 temperature close to if not slightly above the prior maximum of the Holocene epoch. Society
12 must keep global temperature at a level within or close to the Holocene range to prevent
13 dangerous climate change. Global warming of 2°C would be well above Holocene levels and
14 far into the dangerous range.⁵

16 18. In order to correct the energy imbalance of Earth and avoid dangerous heating,
17 atmospheric CO₂ must be reduced to a level below 350 ppm, assuming that the net of other
18 human-made climate forcings remains at today’s level. (A “forcing” is an imposed
19 perturbation of the Earth’s energy balance.) The safe target may need to be even lower than
20 350 ppm, and that will become clearer as our understanding of other forcings increases.

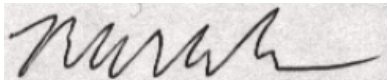
22 19. It is my professional opinion that government action to reduce CO₂ emissions in line
23 with our current and best scientific knowledge is urgently required. In particular, the failure
24 to commence CO₂ emission reductions without further delay, and to undertake other
25 measures consistent with the prescription stated herein and in Youth Petitioners’ proposed

26 ⁵ Hansen, *et al.*, *Assessing ‘Dangerous Climate Change.’*

1 rule, would consign our children and their progeny to a very different planet—one far less
2 conducive to their survival.

3 I swear under penalty of perjury under the laws of the State of Washington that the
4 foregoing is true and correct.
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6 DATED this 16th day of March, 2015,

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8 Pushker Kharecha, Ph.D.
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