Laura H. King (MT Bar No. 13574) Shiloh S. Hernandez (MT Bar No. 9970) Western Environmental Law Center
103 Reeder's Alley
Helena, Montana 59601
Ph: (406) 204-4852
Ph: (406) 204-4861
king@westernlaw.org
hernandez@westernlaw.org

Kyle Tisdel, *pro hac vice* (CO Bar No. 42098)
Western Environmental Law Center
208 Paseo del Pueblo Sur #602 Taos,
New Mexico 87571
Ph: (575) 613-8050
tisdel@westernlaw.org

Counsel for Western Organization of Resource Councils, Montana Environmental Information Center, Powder River Basin Resource Council, and Northern Plains Resource Council

Nathaniel Shoaff, *pro hac vice* (CA Bar No. 256641)
Sierra Club
2101 Webster Street, Suite 1300
Oakland, CA 94612
Ph: (415) 977-5610
nathaniel.shoaff@sierraclub.org

Counsel for Sierra Club

Sharon Buccino, *pro hac vice* (DC Bar No. 432073)
Alison L. Kelly, *pro hac vice* (DC Bar No. 1003510)
Natural Resources Defense Council
1152 15th Street, NW, Suite 300
Washington, D.C. 20005
Ph: (202) 289-6868
sbuccino@nrdc.org akelly@nrdc.org

Counsel for Natural Resources Defense Council

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF MONTANA

GREAT FALLS DIVISION

WESTERN ORGANIZATION OF RESOURCE COUNCILS *et al.*, Plaintiffs, vs. U.S. BUREAU OF LAND MANAGEMENT *et al.*, Defendants.	Case No. CV-16-21-GF-BMM **DECLARATION OF JAMES E. HANSEN IN SUPPORT OF PLAINTIFFS' REMEDIES BRIEF**

I. STATEMENT OF QUALIFICATIONS

I offer this declaration in support of Plaintiffs' Remedies Brief.

My research interests include analysis of the causes and consequences of global climate change using the Earth's paleoclimate history, ongoing global observations, and interpretive tools including climate models. In my most recent work I especially aim to connect the dots all the way from climate observations to the policies that are needed to stabilize climate and preserve our planet for young people, their progeny, and other species.

From 1981-2013, I served as the Director of the NASA Goddard Institute for Space Studies. Since 2013, I have served as the Director of the Program on Climate Science, Awareness and Solutions at Columbia University.

Regarding my other relevant qualifications: I was trained in the space science program of Prof. James Van Allen at the University of Iowa. I received a Bachelor of Sciences degree with highest distinction with double major in physics and mathematics in 1963, a Master of Sciences degree in astronomy in 1965, and a Ph.D. in physics in 1967, all from the University of Iowa. I received the Rossby Research medal, the highest award of the American Meteorological Society, and the Roger Revelle medal of the American Geophysical Union, the Leo Szilard award of the American Physical Society for Outstanding Promotion & Use of Physics for the Benefit of Society, the American Association for the Advancement of Science Award for Scientific Freedom and Responsibility, the American Association of Physics Teachers Klopsteg Memorial Award for communicating physics to the general public.

As well, I am a member of the National Academy of Sciences.

A true and correct copy of my CV is attached as Exhibit A to this declaration.

II. Sources and Evidence

My opinion as to the unacceptable danger presented by additional coal mining and combustion is supported in part by three readily available recent studies. Co-authors included top researchers in the areas of climate science and economics; I served as lead investigator and lead author of all three studies. I hereby, by reference, incorporate into this declaration the analysis and conclusions of these studies. They are:

> Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature,1
>
> Ice Melt, Sea Level Rise and Superstorms: Evidence from Paleoclimate Data, Climate, and Modeling, and Modern Observations that 2°C Global Warming Could Be Dangerous,2 and
>
> Young People's Burden: Requirement of Negative CO_2 Emissions.3

My view not only of the present controversy but of its essential context – our present global crisis with respect to humanity's dangerous interference with the planet's climate system – is reflected in those papers and they, in turn, are the outcome of decades of research. Accordingly, I offer, in Exhibit B, an Expert Basis Report. In it I present a summary of that research, as well as a more complete summary of my relevant views. I hereby, by reference, incorporate into this declaration the information, analysis and conclusions of Exhibit B.

---

1 Published by PLOS One (Dec. 3, 2013) and available at http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0081648.

2 Published by Atmospheric Chemistry and Physics (March 22, 2016) and available at http://www.atmos-chem-phys.net/16/3761/2016/

3 Published by Earth System Dynamics (July 18, 2017) and available at https://www.earth-syst-dynam.net/8/577/2017/

III. Analysis and Reasoning

On the basis of these materials I conclude, without any reasonable doubt, that even in the absence of the presently contested proposal, humanity and nature as we have come to know it are confronted with an urgent, existential threat. The relevant scientific community has examined and quantified that threat on the basis of multiple lines of evidence, so that the risk presented by unarrested human-induced climate change is exceedingly well understood.

Turning now to Plaintiffs' concern over the instant resource management plan: permitting the combustion of up to an additional 110 billion tons of coal, absent exceptionally effective and additional sequestration of the vast bulk of ensuing emissions – a task which has yet to be achieved at relevant scale anywhere in the world -- would substantially accelerate our present drive toward climate tipping points from which there are no foreseeable means of return.4 Indeed, if even "only" 10 percent of the total reserves at issue in this matter is mined and burned – namely, the approximately 11 billion tons of coal that BLM anticipates would be produced – that would exacerbate the effects of warming to date, including, *inter alia*, heatwaves, fire, drought, floods, extreme weather, increased spread of disease, and compromise prospects of avoiding irreversible impacts.

By any measure, 110 billion tons of coal is an enormous load. Two relevant measures for comparison are the amount of coal that has been mined in the United States in recent decades and the quantity of CO_2 that by its combustion would be generated as compared with annual U.S. energy system emissions. As to the first, in the 68-year period for which the U.S. Energy

4 Exploitation and consumption of coal, oil and natural gas are the three primary drivers of global climate change, accounting for 47%, 35% and 14% of cumulative emissions in the 1751-2016 period. *See* Global Fossil Fuel Emissions chart at http://www.columbia.edu/~mhs119/CO2Emissions/. The United States is responsible for 25% of cumulative global emissions. *See* cumulative emissions pie chart at http://www.columbia.edu/~mhs119/CO2Emissions/Emis_moreFigs/.

Information Administration maintains ready access to data, a total of 54.9 billion short tons of coal were produced.5 The maximum quantity of coal at issue in the present case represents, accordingly, twice the quantity produced in the entire U.S. since 1949!

As to the second, utilizing BLM's conversion factor for the type of coal at issue here, we can calculate that ~182.5 billion tonnes (metric tons) of CO_2 will be emitted if the entire 110 billion tons of coal potential in the management area are mined and burned.6 [Of note, BLM's emission conversion factor is ~50% lower than the factors used by US Department of Energy's CDIAC7 or IPCC.8 So the emission estimates could be substantially conservative, which would only reinforce the points made herein.] For comparison we note that, in 2017, U.S. energy-related CO_2 emissions were 5.14 billion metric tonnes.9 Accordingly, upon full consumption the maximum potential coal production from the challenged resource plan area could yield more than 35 times the total CO_2 emissions from all U.S. 2017 energy sources.

Widespread, at-scale, and economic power-plant carbon capture and sequestration – including safe transportation and permanent disposal of the ensuing CO_2 – remains a mere hope. Accordingly, if the coal at issue in the challenged resource plans is exploited – indeed, if even a significant fraction of it is developed – then, by that action, we may press the climate system past

---

5 Calculations based on coal data from U.S. EIA, Total Energy, Table 6.1 Coal Overview, https://www.eia.gov/totalenergy/data/browser/?tbl=T06.01 (downloaded in excel format on May 17, 2018).

6 Wright Area FEIS, p.4-140, T. 4-39, "Estimated Annual CO2 Emissions Produced from Combustion of Coal Produced from WAC LBA Tracts." Footnote 2 to the table states: "Determined using emission factor of 1.659 tonnes CO_2/ ton of coal burned (USDOE 1994)." https://eplanning.blm.gov/epl-front-office/projects/nepa/67033/82290/97260/01WrightCoalVol1.pdf

7 Carbon Dioxide Information Analysis Center at http://cdiac.ess-dive.lbl.gov/pns/convert.html#6.

8 Intergovernmental Panel of Climate Change, Table 7.2 of the AR5-WG3/mitigation report at https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter7.pdf.

9 EIA, Today in Energy, https://www.eia.gov/todayinenergy/detail.php?id=34872 (accessed May 19, 2018).

already looming tipping points. For this reason, the program in question can only be considered as a monstrous assault on the environment.

Last year, in our study "Young People's Burden," my expert co-authors and I calculated the amount of carbon drawdown that would be needed to preserve a viable climate system, and the approximate cost thereof. Admittedly the calculations in our optimistic scenario required rational action beyond that to which most nations, including notably the United States, have to date committed. For instance, our most optimistic scenario presumed a world-wide near phase out of CO_2 emissions by the year 2050, thus requiring annual emissions reductions of at least a few percent per year. A less ambitious schedule will amplify the carbon drawdown requirement and the cost, perhaps well beyond feasibility, in the later part of this century. We presumed in this scenario, as well, that reforestation and other "natural" carbon drawdown reforms and programs, yielding a truly massive net carbon drawdown of 100 PgC, might be adopted by communities and nations with no net additional cost imposed on consumers or nations – since these efforts arguably produce tangible co-benefits beyond their impact in reducing climate risk, thus rendering them potentially economic in their own right.

Accordingly, we restricted ourselves, again for this most optimistic scenario, to consideration of an estimated cost for the additional minimum of 53PgC drawdown that would be needed to restore planetary energy balance when accompanied or preceded by plausible reductions of short-lived non- CO_2 greenhouse gases. We determined that this additional carbon drawdown would need to rely on unproven-at-scale technological methods, including direct air capture and sequestration, in light of the saturation of the potential natural sinks for carbon. Our total estimated cost of available or anticipated technological means of drawing down that

additional 53PgC ranged from $8-18.5 trillion.10 Even if spread over the 80-year, 2020-2100 period, we deemed the ensuing $100-230 billion annual cost to be very considerable indeed.

It is important here, similarly, to consider the cost of the additional carbon drawdown that would be needed in the event that the coal under question in the challenged resource plans were to be exploited and burned in present power plants (which provide for no carbon capture and sequestration) without a dramatic exacerbation of the climate crisis.

Our cost projections of *Young People's Burden* were based on the weight of the carbon in the excess atmospheric CO_2; accordingly, we must first convert the potential release of the project CO_2 to its weight in carbon. The atomic weight of carbon is 12 and that of oxygen is 16. We can multiply the estimated metric weight of the anticipated emissions of project CO_2, i.e., 182.5 billion tonnes CO_2, by a factor of 12/44, yielding ~50 PgC (~50 billion tonnes of carbon). That is the additional carbon this project, if allowed to proceed, would inject into the air.

The allowable budget for fossil fuel emissions into the atmosphere is already fully subscribed, if young people are to have any hope of avoiding climate catastrophes. By that I mean the warming that has already occurred, plus the additional warming "in the pipeline" due to the planet's present energy imbalance caused by the slow response of the climate system to the changed atmospheric composition, plus the warming that will occur due to the fact that we cannot instantly stop emissions today (rather they must be phased down as rapidly as practical) – these three terms mean that we have already exceeded allowable emissions. Indeed, that is the reason why we must exploit "natural" mechanisms such as reforestation and improved agricultural practices to draw down CO_2 as much as practical.

If the United States chooses to emit another 50 PgC from coal resources, it will be fully

10 *Young Peoples Burden* at 591.

accountable for extracting that amount of CO_2 from the air; the science is crystal clear on that requirement.11 Opening up whole new resources now requires that those emissions be captured, either at the time of emission or sucked out of the air soon thereafter, for the sake of our young people and future generations.

Let us estimate the cost of that carbon extraction, if we are to offset and thus avoid its additional climate disrupting impact. The cost estimate is easy because the potential CO_2 emissions, ~50 PgC, is nearly the same as the 53 PgC costed in "Young People's Burden." The latter cost estimate, $8-18.5 trillion, is reduced to $7.5-17.5 trillion, still a considerable sum. If the energy market were rational, that cost would be incorporated into the price of coal.

Of course, the above are not the only costs that exploitation of additional coal reserves would impose on the public, and in fairness all social costs of exploitation and consumption of coal, including health costs and environmental costs other than climate, should be incorporated into the price of coal. The same is true for other fossil fuels and other energy sources.

As a matter of practical reality, regrettably, there is as yet no global or national program to draw down excess atmospheric carbon on the scale needed either to offset legacy emissions or to offset any emissions from any additional massive fossil fuel projects. The potential for such drawdown needs to be assessed. Work on the issues that arise is at a very early stage.12

Absent a global carbon drawdown program sufficient to offset emissions, such as those from the proposed project, all new significant emissions intensive projects, including the present

11 This 1-for-1 extraction requirement arises due to the "back-flux" of CO2, largely from ocean outgassing, that would occur during the period of extraction (Young People's Burden at 587). This back-flux adds to the difficulty of extraction.

12 *See*, e.g., B Griscom et al., *Natural Climate Solutions*, Proceedings of the National Academy of Sciences (Sept. 5, 2017); DJ Beerling, J Hansen, et al, *Farming with crops and rocks to address global climate, food and soil security*, Nature Plants (19 Feb 2018). *See* also, M Wood and D Galpern, *Atmospheric Recovery litigation: Making the Fossil*

challenged proposal, must be deemed environmentally calamitous.

If such a global drawdown program is developed, it might be feasible for the purchasers of coal to pay a fee sufficient to pay for the drawdown of the resulting carbon, as well as to cover other costs imposed on the environment and human health. Here the climate-fee alone likely would need to be, as illustrated, in the neighborhood of $10 trillion. The fee should be collected in proportion to coal use; thus, if the entire coal field were exploited in the next 80 years at a uniform rate, the annual fee would be $125 billion, in present dollars. On the other hand, if only 10 percent of the resource is extracted in 80 years the annual cost is only $12.5 billion.

The crucial point is that this cost should be attached to the price of coal now. It should not be allowed for today's adults to dump this cost on their children.

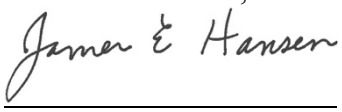
IV. CONCLUSION

It is almost certain that the above costs would be deemed unmanageable by BLM's coal patrons, in part because the costs will far exceed the value of the coal that might be mined – especially when these costs are compared with other sources of non-fossil energy, including renewables, hydro and nuclear power. This is only to note that, when the full costs of coal (and other fossil fuels) are fully taken into account, their exploitation becomes uneconomic.

For over six decades the United States coal program has proceeded to enable corporate exploitation of reserves because little to no regard has been taken of climate-related and other costs imposed on our nation. If our climate system is allowed to pass tipping points that amplify and accelerate climate change and climate impacts, we must recognize that we will be pressing young people and their progeny towards points of no return. There is no realistic prospect of reversing sea level rise or re-growing the ice sheets on Greenland and Antarctica, which

developed naturally over tens and hundreds of thousands of years, nor of restoring species driven to extinction. In reality, there is now no realistic way to substantially increase coal utilization and simultaneously preserve a viable climate system. That fact needs to be honestly reflected in any appropriate NEPA analysis. Indeed, the task of our age is to restore planetary energy balance by sharply phasing out emissions and drawing down legacy atmospheric CO_2. This is required, since a viable climate system remains central to our lives and, more important still, to the prospects of our children and their progeny.

Signed this 24th day of May, 2018 in New York, New York.



James E. Hansen, Director
Climate Science, Awareness and Solutions
Earth Institute, Columbia University
New York, New York, USA