Civil Rights and Civil Liberties Subcommittee Hearing on:

"Examining the Oil Industry's Efforts to Suppress the Truth About Climate Change"

Written Testimony

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I thank Jamie Raskin, Chair of the House Subcommittee on Civil Rights and Civil Liberties," Ranking Member, Chip Roy, and all Subcommittee members for giving me this opportunity to testify about my experience as a consultant on the carbon cycle and climate at Exxon Research and Engineering, an issue of major importance here.

I was recruited to work as an Exxon Research and Engineering consultant by colleague Andrew Callegari in 1981. I made it clear that for the Exxon Lab's science to be credible and for me to participate the work needed to be published in reputable scientific journals subject to peer review. This was welcomed, and though I remained a paid consultant only until 1987, I continued to publish science work with Exxon colleagues thereafter. Our group published eight peer reviewed papers, three as a paid consultant, and five thereafter.

My work focused on understanding the carbon cycle and on the climatic effects of CO2 emissions and to bring Exxon colleagues Brian Flannery and Haroon Kheshgi up to speed on the latest research via tutorials and published papers. The Exxon scientists were excellent researchers and were soon authoring papers themselves. I am gratified that we did important work that is still cited today. The quality of the scientific work done by our Exxon research group was high.

It would be a distraction to go into technical detail on our findings here. Suffice it to say that our research was consistent with findings of the UN Intergovernmental Panel on Climate Change on human impacts of fossil fuel burning, which is that they are increasingly having a perceptible influence on Earth's climate. Impacts of climate change have become more pronounced over time. Scarcely a day goes by without a news stories of major wildfires in the American West, riverine flooding unseen for hundreds of years, droughts, the disappearance of mountain glaciers, tundra melting, more intense hurricanes, melting sea ice in the arctic and glacial calving in Antarctica, all of which are consistent with the uncertainty spread of IPCC model predictions. If anything, adverse climate change from elevated CO2 is proceeding faster than the average of prior IPCC model projections.

I worked with Exxon researchers for several reasons. First, they were excellent scientists who made a positive contribution to the research. Second, I believed that having Exxon scientists on published papers acknowledging the reality of climate change

could help reduce the polarization surrounding climate change science. Third, I hoped that the work could help persuade Exxon to invest in developing the energy solutions the world needed.

If this seems naïve, consider that M. Stanley Wittingham, 2019 Nobel Prize winner in Chemistry, the "founding father" of rechargeable lithium batteries employed massively in cellphones, laptops and, most importantly, electric cars -- put in 16 years at Exxon Research and Engineering overlapping the period of our group's work. Imagine that in some parallel universe Exxon's management had connected the dots and put a major effort into developing electric cars powered by this technology, much as Elon Musk did starting from zero decades later with Tesla Motors. After all, Exxon had an inside track and could see from our climate modelling work that sometime in the 21st century the world would have to transition away from fossil fuel. So why not develop a business plan twenty years earlier Exxon like Musk's, who is now building a "Giga" battery plant in Nevada, the largest factory in the world, to power electric transportation cost effectively by employing economies of scale to drive down battery cost. Exxon with its billions in quarterly profits could certainly have afforded it.

I leave to experts a detailed discussion of Exxon's outward facing disinformation and funding of climate change deniers even as our in-house research was predicting just the opposite. They are, as Naomi Oreskes calls them, "Merchants of Doubt" who capitalize on the fact that more people watch TV ads than read scientific literature. Exxon ads today tout that the company is working on carbon capture from smokestacks and carbon neutral fuels derived from algae. Even if true in a public relations sense, this is going nowhere soon. Exxon has no market ready products after many years of inaction. Today I can buy a lithium battery powered electric car or lithium battery Powerwall to store electric power from Tesla, who started much later than Exxon. But Exxon gas station attendants would think me deluded if I asked for the pump dispensing carbon neutral algae-derived gasoline. So would an electric utility if I wanted to sign up for CO2 emission free natural gas electricity incorporating Exxon carbon capture and storage.

I want to emphasize that although my experience with Exxon researchers was positive, I was greatly distressed by the climate science denial campaign that Exxon's front office launched around the time I stopped working as a consultant for Exxon. The advertisements that Exxon ran in major newspapers raising doubts about climate change were contradicted by the scientific work we had done and continued to do. Exxon was publicly promoting views that its own scientists knew were wrong. This was immoral and has greatly set back efforts to address climate change.

Papers Published While I was a Consultant

* Hoffert, M.I., Flannery, B. P., Callegari, A. J., Hseih, C. T., and Wiscombe, W., 1983. Evaporation-limited tropical temperatures as a constraint on climate sensitivity. Journal of the Atmospheric Sciences 40, No. 7, 1659-1668.

* Flannery, B. P., Callegari, A. J., and Hoffert M. I., 1984. Energy balance models incorporating evaporative buffering of equatorial thermal response, in Climate Processes and Climate Sensitivity, Maurice Ewing Volume 5, J. Hansen and T. Takahashi, editors, American Geophysical Union, Washington, DC, pp. 108-117.

* Hoffert, M. I., Flannery, B. P., 1985. Model projections of the time-dependent response to increasing carbon dioxide, in Projecting the Climatic Effects of Increasing Carbon Dioxide, United States Department of Energy, M. C. MacCracken and F. M. Luther editors, Lawrence Livermore, Livermore, Livermore, CA., 151-168.

Papers After I Stopped my Consulting Agreement

* Kheshgi, H. S., Hoffert, M. I. and Flannery, B. P., 1991. Marine biota effects on the compositional structure of the world oceans. J. Geophys. Res., 96: 4957-4969.

* Flannery, B. P., Kheshgi, H. S., Hoffert, M. I. and Lapenis, A. G., 1993. Assessing the effectiveness of marine CO2 disposal. Energy Convers. Mgmt, 34: 983-989.

* Kheshgi, H. S., Flannery, B. P., Hoffert, M. I. and Lapenis, A. G., 1994. The effectiveness of marine CO2 disposal. Energy, 19: 967-974.

* Jain, A. K., Kheshgi, H. S., Hoffert, M. I. and Wuebbles, D. J., 1995. Distribution of radiocarbon as a test of global carbon cycle models. Global Biogeochem. Cycles, 9: 153-166.

* Hoffert, M. I., Caldeira, K., Benford, G., Criswell, D. R., Green, C., Herzog, H., Jain, A. K., Kheshgi, H. S., Lackner, K. S., Lewis, J. S., Lightfoot, H. D., Manheimer, W., Mankins, J. C., Mauel, M. E., Perkins, L. J., Schlesinger, M. E., Volk, T., and Wigley, T. M. L.: 2002, Advanced technology paths to global climate stability: energy for a greenhouse planet, Science 298, 981-987.

Some Examples of Exxon's Denial of its Own Climate Research

* In a 1996 speech at the Economic Club of Detroit, Exxon CEO Lee Raymond stated: "Proponents of the global warming theory say that higher levels of greenhouse gases – especially carbon dioxide – are causing or will cause global temperatures to rise. … Currently, the scientific evidence is inconclusive as to whether human activities are having a significant effect on the global climate."

This is false. Exxon's own scientists knew climate change was real and serious when he made this statement.

* In a 1997 speech at the World Petroleum Forum, Exxon CEO Lee Raymond made a series false and highly misleading statements about climate change. I call them "bloopers," typical of someone lacking elementary understanding of the scale of human CO2 emissions in relation to the biosphere. Plants and animal both consume CO2 (photosynthesis) and produce it (respiration, combustion and decay) at large rates but a very small residual carbon source or sink from the biosphere. Raymond said: "[O]nly four percent of the carbon dioxide entering the atmosphere is due to human activities – 96 percent comes sfrom nature. *Leaping to radically cut this tiny sliver of the greenhouse pie on the premise it will affect climate defies common sense and lacks foundation in our current understanding the climate system*."

I and my Exxon scientist colleagues (and any serious student of the carbon cycle) know natural emissions of CO2 are nearly perfectly balanced by natural absorption of CO2 by photosynthesis. Nearly all of the increase in atmospheric CO2 levels – not a small 4% sliver – is due to human activities, primarily burning fossil fuel.

- In a 1998 ExxonMobil pamphlet, Exxon stated, "[F]or many years, we've carefully studied and worked to increase understanding of the issue of global climate change – often referred to as 'global warming.' … This recent warming trend falls well within the range of natural changes in Earth's temperature over the past 250,000 years."

In fact, Exxon scientists knew that the recent warming trend was not within the range of natural changes. The rate of temperature increase from fossil fuel burning is far higher than any in the past million years.

- A 2000 ExxonMobil advertorial called "Unsettled Science" is full of statements that were contradicted by the work of Exxon's scientists, such as the statement that "it is impossible for scientists to attribute the recent small surface temperature increase to human causes." This is nonsense. The impact of humans on climate and environmental change today is so massive that earth scientists call the present era "The Anthropocene," meaning humans are the dominant factor.

* I cannot see into Exxon management's heart. Whatever its intent -- willful ignorance, stymieing an effective response to preserve quarterly profits, or simply an incomprehensible refusal to incorporate their own world class researchers' results into their business plans (demonstratively counterproductive long term) -- what they did was immoral.

They spread doubt about the dangers of climate change when its researchers were confirming how serious a threat it is. The effect of this disinformation was to delay action internally and externally. They deliberately created doubt when internal research confirmed how serious a threat it was. As a result, homes and livelihoods will likely be destroyed and lives lost. Major energy corporations like Exxon Mobil may face bankruptcy if the Paris Climate Accords succeed in phasing out fossil fuel energy to preserve the habitability of high tech civilization and Exxon remains competitively unprepared for a carbon emission free energy world.