

Written Statement to the Congressional Oversight Committee by Dr. Edward A. Garvey

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Thank you for the opportunity to speak before the committee. I am here to testify that Exxon considered rising CO₂ levels and the potential for CO₂-driven climate change to be of sufficient concern to commit to a significant research effort in 1978. I personally participated in the data collection for this research effort and I had first-hand knowledge of my management's objectives in collecting these data. I'd like to briefly describe to you some of the pertinent events of my five-year tenure with the Exxon Research and Engineering Company.

After graduating from college as a chemical engineer in July of 1978, I was hired to assist a senior scientist at Exxon (Dr. Henry Shaw) in the development of a greenhouse gas research project. Exxon scientists such as Dr. J. Black and Dr. Shaw has raised this as an issue to the corporation. I was told, by Dr. Shaw and possibly others, that Exxon undertook this research to earn itself a "place at the table" among scientists, policy makers, etc., regarding climate change and the potential responses to it. The research was intended to make an important contribution to the understanding of CO₂ and climate science. The program was also intended to constitute a uniquely Exxon contribution, something no other entity could readily do. In developing the program, we worked closely with Doctors Wallace S. Broecker and Taro Takahashi, geochemists with what was then the Lamont-Doherty Geological Observatory of Columbia University. (It is now known as the Lamont-Doherty Earth Observatory.) Dr. Shaw, and perhaps others at Exxon, felt that a joint investigation with well-respected researchers, such as these scientists, would lend credibility to the effort and also guarantee that the work would have substantive scientific importance. The Columbia scientists insisted that the findings be freely shared, without restrictions on their publications or on the scientists' non-project activities. As the work progressed, we would later add Dr. Ray Weiss of the Scripps Institute of Oceanography to the team of academics participating in the project. By working with leading scientists from academia and by conducting original and highly useful research, Exxon felt that its opinions would be taken seriously regarding greenhouse gases and possible solutions to the problem.

We ultimately selected a supertanker, the Esso Atlantic, to set up a dedicated monitoring system. At the time, the ship was the fourth largest ship in the world, a flagship of the Exxon International fleet, with a displacement of over 500,000 tons. The monitoring equipment would obtain measurements of CO₂ in surface water and in air as the ship traversed its normal routes. We permanently installed an extensive sampling system and a computer-based data collection system on the ship. The very large capacity of the ship meant the vessel was dedicated to the Gulf of Mexico - Persian Gulf route by way of Cape Horn of Africa. Thus, our equipment would cross equatorial zones in the central Atlantic and western Indian Oceans multiple times each year. Use of this ship on its dedicated route provided a high frequency sampling of the equatorial oceans and was viewed as a unique contribution from Exxon to the study of CO₂. The program's goal was to understand the role of the ocean in the global carbon cycle and its role in the storage of anthropogenic CO₂. Our study focused, in particular, on the cycling of CO₂ between the atmosphere and ocean in the equatorial region.

However, an oil tanker is not a research vessel, and on-board conditions were not designed to support the high precision instrumentation needed to conduct the study. Exxon expended a very significant development effort to design equipment capable of withstanding the harsh environment, going so far as to design and build a unique state-of-the-art gas chromatograph for CO₂ measurement, based on the analytical techniques developed by Dr. Weiss of the Scripps Institute. Exxon invested heavily in the project, spending over \$900,000 per year at the program's peak (about \$2.5M in today's dollars) and

planned to make known its commitment to greenhouse gas studies. The video tapes of me on the ship that are now on the internet were made by professional photographers in 1979 with the intention of presenting the program to shareholders. The tanker project required the cooperation of multiple divisions within Exxon: the Exxon Research and Engineering Company (which employed Dr. Shaw and me), Exxon International (which scheduled and maintained the Esso Atlantic), and Exxon USA (which offloaded crews and equipment from the tanker in the Gulf of Mexico). Because of the degree of coordination among major wholly-owned companies as well as the scale of the research investment, it was my understanding that the Exxon corporate board was aware of the project and approved its implementation. I was told by my supervisors (Dr. Shaw and possibly others) that the project's progress was presented directly to the corporate board.

During the early stages of the planning, Exxon also considered other oil tanker routes that could provide similar opportunities to study ocean chemistry on a regular basis. Exxon hoped to get federal participation in this work, in part to get federal recognition of the importance of Exxon's research. We made a presentation to the then head of the Air Resources Laboratory (ARL) of the National Oceanic and Atmospheric Administration (NOAA), Lester Machta, in the hopes of winning federal participation. (March 23, 1979). A copy of the presentation from the Exxon archives at the University of Texas-Austin is attached. The federal government chose not to participate, however, and Exxon funded the research entirely on its own for the next several years.

Exxon also considered a study to measure the dilution of atmospheric radiocarbon by fossil fuel CO₂ to augment the other lines of evidence that showed the growing prevalence of fossil fuel CO₂ in the atmosphere. It was our plan to measure carbon isotope levels in vintage wines going back to the 1850s. We consulted with Dr. Ralph Kunkee, a well-known professor in wine science at the University of California at Davis. Exxon chose not to pursue this line of research, but I mention it to emphasize how wide-ranging Exxon's thinking was at that time in considering how the company might contribute to climate science.

Around 1980 or so, unrelated to the tanker project, Exxon expanded its research efforts into climate modeling. They hired several scientists from academia, including Dr. Brian Flannery, to conduct this line of research. About 2 years later, the oil market, which had been quite lucrative for Exxon in the 1970s, collapsed. Exxon began to lay off staff across the corporation and also ended the tanker project abruptly, rather than winding it down in a way that would have allowed for processing, evaluation, and publication of the collected data. In particular, this meant that, although we had collected a lot of data, we had not yet fully processed it to obtain final values to support further analysis. To that point, we had only one published journal article on our work, a paper published in the peer-reviewed journal on Instrumentation and Measurement of the Institute of Electrical and Electronics Engineers (IEEE). which described the design and operation of the CO₂ monitoring equipment in the harsh environment on-board the tanker. I have included a copy of the article with this statement.

Although the reduction of the data into a workable format was not completed when the tanker project was discontinued, we were able to examine portions of the data set. We observed significant increases in oceanic CO₂ levels during our equatorial crossings relative to temperate ocean levels, confirming the predictions of oceanic surface concentrations by early models of CO₂ cycling. We also observed the plume of the Amazon River hundreds of miles offshore, a phenomenon that had not been previously documented.

Although Exxon discontinued the tanker project, it continued its climate modeling research, at least while I remained there. With the end of the project, the layoffs at Exxon and the lack of further support for my

studies on the global carbon cycle, I opted to leave Exxon in 1983 and continue my graduate studies at Columbia, but in estuarine, rather than oceanic, geochemistry.

The years I spent at Exxon were an exciting time for research in general, and particularly for climate studies. Although we only published one journal article, the data we collected was ultimately incorporated into several papers concerning the global carbon cycle and the fate of increased anthropogenic CO₂ by the Columbia scientists. During my tenure there, I had the chance to work with some of the leading scientists in geochemistry and climate. Although I was very disappointed when Exxon discontinued the study, I am still grateful for the opportunity I was afforded.

In summary, the importance of my testimony is to note that Exxon knew of the anthropogenic climate change issue and considered it a sufficiently important problem to the company, and perhaps to society, that it funded and undertook a major research investigation of the world's atmospheric and oceanic CO₂ levels. While the research at Exxon did not continue long enough to fully analyze and interpret the results, the data we collected eventually became part of the scientific work published by Columbia scientists, further expanding the understanding of the ocean's role in CO₂ cycling and climate change. Although the corporation chose to discontinue this research, it continued to fund climate modeling research for at least several years after it terminated the tanker project. For the work that I was involved in, Exxon's efforts were intended to reduce the uncertainties associated with climate change forecasts and CO₂ cycling. In both instances, the corporation was well aware of the potential problem caused by rising CO₂ levels.