

SMOKE AND FUMES

The Legal and Evidentiary Basis for Holding
Big Oil Accountable for the Climate Crisis



CENTER for INTERNATIONAL
ENVIRONMENTAL LAW

SMOKE AND FUMES

THE LEGAL AND EVIDENTIARY BASIS FOR HOLDING BIG OIL ACCOUNTABLE FOR THE CLIMATE CRISIS

“He who can but does not prevent, sins.”

–Antoine Loysel, 1607

“Victory Will Be Achieved When...Average citizens ‘understand’ (recognize) uncertainties in climate science; recognition of uncertainties becomes part of the ‘conventional wisdom’ [and]...Those promoting the Kyoto treaty on the basis of extant science appear to be out of touch with reality.”

–American Petroleum Institute, 1998

NOVEMBER 2017



© 2017 Center for International Environmental Law (CIEL)

About CIEL

Founded in 1989, the Center for International Environmental Law (CIEL) uses the power of law to protect the environment, promote human rights, and ensure a just and sustainable society. CIEL is dedicated to advocacy in the global public interest through legal counsel, policy research, analysis, education, training, and capacity building.



Smoke and Fumes: The Legal and Evidentiary Basis for Holding Big Oil Accountable for the Climate Crisis by The Center for International Environmental Law is licensed under a Creative Commons Attribution 4.0 International License.

Acknowledgements

This report was authored by Carroll Muffett and Steven Feit and edited by Amanda Kistler and Marie Mekosh, with additional contributions by Lisa Anne Hamilton. Many people have contributed to the Smoke and Fumes research over the last five years through insights, comments, and sharing of their own research, including Kristin Casper, Kert Davies, Brenda Ekwurzel, Peter Frumhoff, Lili Fuhr, Richard Heede, Kathryn Mulvey, Naomi Oreskes, Dan Zegart, and others. Nate Pauzenga designed the Smoke & Fumes website, which makes navigating this information possible. This report, and the extensive body of research that underlies it, were made possible with generous support from the Wallace Global Fund, V Kann Rasmussen Foundation, WestWind Foundation, the KR Foundation, and Heinrich Boell Foundation. Errors and omissions are the sole responsibility of CIEL.

This briefing note is for general information purposes only. It is intended solely as a discussion piece. It is not and should not be relied upon as legal advice. While efforts were made to ensure the accuracy of the information contained in this report and the above information is from sources believed reliable, the information is presented “as is” and without warranties, express or implied. If there are material errors within this briefing note, please advise the author. Receipt of this briefing note is not intended to and does not create an attorney-client relationship.

Contents

1	Executive Summary
2	Introduction
3	Part 1
	The Legal Basis for Accountability: Fundamental Elements of Responsibility under Tort, Civil Liability, and Human Rights Law
	Climate Litigation: Causation, Attribution, and the Scientific Case Against Major Carbon Producers
	The Fundamental Elements of Responsibility: Notice of Risk and the Opportunity to Avoid or Reduce Risk
	Corporate Responsibility for Human Rights Violations Arising from Climate Change
7	Part 2
	The Evidentiary Basis for Accountability: The Evidentiary Basis for Accountability
	Oil on Notice: Evidence of Early Industry Awareness of Climate Risks
	Documentary Evidence Demonstrates Oil Industry was on Notice of Potential Climate Risks by 1957
	The Petroleum Industry Engaged in Coordinated Research and Communications on Air Pollution Issues from the 1940s Onward
	The Industry Undertook Coordinated Research into Many Subjects Relevant to the Causes and Impacts of Climate Change
	The Petroleum Industry was Unequivocally Warned of Climate Change Due Primarily to the Combustion of Fossil Fuels By 1968
	From 1977 to 1982 Exxon Scientists Repeatedly Confirm the Science of Climate Change
	As Early as the 1970s and No Later than the 1980s, Climate Change Projections Were Being Used in Business and Operational Planning
	In the 1990s, Even as it Acknowledged Climate Realities Internally, the Oil Industry Intensified its Public Campaigns Against Climate Science
	The Oil Industry Continued to Fund and Promote Climate Misinformation and to Oppose Climate Mitigation Actions Throughout the 2000s into the Current Decade
	A Systemic Problem
	The Petroleum Industry Was Researching Technologies that Could Have Been Used to Mitigate or Avoid Climate Change
	Summary of Industry Knowledge of and Action on Climate Change
	Key Findings
	Beyond Exxon and Beyond the US: The Expanding Investigations into Climate Denial
26	Appendix I
	Investor-Owned Carbon Majors, Ranked by Cumulative Emissions Contribution
28	Appendix II
	A Note on Sources
29	Appendix III
	A Note on Industries and Companies Addressed in this Synthesis
31	Endnotes



Executive Summary

Climate change poses a fundamental threat to ecosystems, nations, human rights, and human lives. It is caused by the emission and accumulation of greenhouse gases in the atmosphere, primarily due to the combustion of fossil fuels—oil, gas, and coal. This report was written to answer the questions: What did the fossil fuel companies know? When did they know it? What did they do about it? For what can we hold them legally and morally responsible?

Recent years have seen dramatic advances in the science of climate attribution, allowing researchers, investigators, and litigators alike to identify both climate harms and potential defendants with ever greater precision. Researchers have identified ninety major carbon producers, including fifty-one investor-owned companies, that are responsible for nearly two-thirds of historical carbon and methane emissions. At the same time, new techniques are enabling ever more precise calculations of the relationship between CO₂ emissions, global temperature and sea level increases, and climate impacts. For the first time, scientists and plaintiffs can trace the contributions of individual companies to specific climate impacts and climate-related disasters. These techniques, and the ability of affected communities to draw on them, are evolving and rapidly improving.

Whether companies can be held legally liable for these impacts depends on whether they had the ability to foresee climate harms and the ability and opportunity to avoid or reduce those harms.

Through company documents, scientific studies, and other evidence, this report



shows that fossil fuel companies have been aware of the risks of climate change, and their products' role in exacerbating those risks, for at least six decades. At least one major oil company was on notice of evolving climate science as early as 1957. By 1958, the industry as a whole was studying carbon dioxide in the atmosphere through its industry organization the American Petroleum Institute. From 1968 onward, the industry was repeatedly warned of the climate risks of its products, including by its own scientists, and often in dire terms.

From the 1960s onward, the oil industry was actively patenting technologies that might have been deployed to reduce greenhouse gas emissions or accelerate the shift to clean energy. Industry leaders argued against public research into cleaner technologies—or absorbed public research dollars for themselves—even as they argued internally that deploying new technologies would reduce their own profits. By no later than the 1980s and perhaps far earlier, major oil companies were incorporating climate risks into their operational planning for major projects, and taking steps to protect their own assets from long-term climate impacts.

Yet throughout the 1990s and 2000s, and despite company documents supporting the scientific consensus on climate change, the petroleum industry engaged in a massive public relations campaign against public understanding of climate science.

As this report demonstrates, a robust and growing body of documentary evidence indicates that the major oil and gas companies whose products are substantially responsible for global greenhouse emissions and the resulting climate crisis had early and repeated notice of climate risks, and numerous opportunities to avoid or reduce those risks. Abundant evidence of industry support for climate denial suggests they chose a different path. Evaluated under the laws of tort, the law of non-contractual responsibility in civil jurisdictions, and international human rights law, there are ample grounds to hold companies responsible for those choices.

While the present report focuses on US-based oil and gas companies, the relevant inquiry does not end there. Other industries, including the coal industry have well-documented histories of climate denial. And clear, if currently limited, evidence demonstrates that climate denial was a transnational phenomenon, involving corporate activities—and active deception campaigns—in multiple countries.

One thing is already clear: For major carbon producers around the world and the communities harmed by their decades of action and inaction on climate change, the investigations into what Exxon knew are the beginning of this story, but they are by no means the end.

Introduction

Climate change poses a fundamental threat to ecosystems, nations, human rights, and human lives. It is caused by the emission and accumulation of greenhouse gases in the atmosphere, primarily due to the combustion of fossil fuels—oil, gas, and coal. This report was written to answer the questions: What did the fossil fuel companies know? When did they know it? What did they do about it? For what can they be held legally and morally responsible?

The report begins by exploring the fundamental principles of legal responsibility in both tort and human rights law. The objective is not to assess the elements of a particular claim, but to distill the core components of legal responsibility from tort and human rights

law that underpin the allocation of liability across an array of legal domains and legal systems.

We then review the factual background of the petroleum industry's knowledge and awareness of climate change. We present the best available evidence documenting the petroleum industry's understanding of climate change at critical moments throughout the twentieth and into the twenty-first centuries, along with research the industry conducted into alternative explanations for observed climatic changes and potential carbon emissions solutions. Finally, we offer examples of actions taken by the industry to confuse or mislead the public.

The evidence in this report comes from several sources, including the Center for

International Environmental Law (CIEL), Climate Investigation Center's Climate Files, *InsideClimate News*, Union of Concerned Scientists, *Los Angeles Times* and Columbia School of Journalism, *DeSmog Blog*, Corporate Europe Observatory, and others. A more detailed description of these sources, their limitations, and their treatment in this synthesis is set forth as Annex II to this report.

To facilitate direct access to relevant evidence, hyperlinks to cited documents have been provided wherever feasible. At the time of publication (Nov. 2017) all hyperlinks were functional and accurate, although some linked documents are subject to paywalls or other limitations.



PART 1

The Legal Basis for Accountability

Fundamental Elements of Responsibility under Tort, Civil Liability, and Human Rights Law

Climate Litigation: Causation, Attribution, and the Scientific Case Against Major Carbon Producers

Across countries, legal systems, and many fields of law, the essential links in the litigation chain are constant—an identifiable plaintiff, identifiable defendants, a causal chain that connects the harms suffered by the fo to the actions or inactions of the other. Establishing the links in that causal chain—particularly in tracing specific climate impacts to individual defendants or groups of defendants—is a common challenge facing potential plaintiffs or others who would hold polluters accountable for their contributions to climate change.

Recent years have seen dramatic advances in the science of attribution at every link in this chain. As climate impacts accelerate worldwide, a growing body of evidence is enabling scientists, governments, and litigators to identify and quantify the impacts of climate change on countries, cities, communities, and even individuals. From farmers in the Peruvian Andes,¹ to communities in the Philippines² and Massachusetts,³ to flood control engineers in California,⁴ ever growing numbers of **plaintiffs** are able to trace the harms they are suffering or the risks they face to the rising impacts of climate change.

At the same time, analyses of historical production data for fossil fuels has identified a discrete group of potential **defendants** whose contributions to the



© 2019/Pixabay

climate crisis are identifiable, measurable, and significant.

In 2013, Richard Heede of the Climate Accountability Institute⁵ released a study wherein he traced historical carbon dioxide and methane emissions embedded in all the traceable oil, gas, coal, and cement produced from 1751 through 2010.⁶ By focusing on fossil fuel producers (and cement manufacturers) at the top of the product chain, Heede could tabulate how much of historical emissions flowed from those companies directly, or from the combustion of their fossil fuel products.

Recent years have seen dramatic advances in the science of attribution at every link in this chain.

This research identified what have become known as the “Carbon Majors,” a group of ninety companies responsible for approximately two-thirds of industrial carbon emissions since the beginning of the industrial revolution in 1751,⁷ and drawing on records from as early as 1854.⁸

Fifty of these companies are investor-owned (e.g. Chevron, ExxonMobil, BP); thirty-one are state-owned enterprises (e.g. Saudi Aramco, Statoil); nine are industries run entirely by government, such as in China and Poland.⁹

The study was updated in 2014 to cover emissions through 2013.¹⁰ A supplemental analysis released by Climate Accountability Institute and Carbon Disclosure Project in June 2017

demonstrated that more than half of global CO₂ emissions since 1988 can be linked to just 25 producers, including five leading investor-owned oil companies: ExxonMobil, Shell, BP, Chevron, and Total.¹¹ If Saudi Arabia carries out its plan to list state-owned Saudi Aramco on a public stock market, Aramco would join the other investor-owned companies on this list.

In September 2017, researchers from the Union of Concerned Scientists (UCS) and Oxford University collaborated with Heede to combine these fields of attribution science for the first time. The researchers disaggregated major carbon producers' historical emissions by year and constructed emissions profiles for each company over time.¹² By tracing emissions through time, the team was able to attribute fractions of the accumulation of carbon dioxide in the atmosphere, increases in atmospheric temperature, and elevation of the sea level to individual companies based on the timing of their commercial activities. Just as significantly, the paper demonstrated how hundreds of excess deaths from a single extreme weather event could be attributed to climate change and ultimately, in part, to the oil, gas, and coal produced by major carbon producers.¹³

This new research is a leap forward in attribution science. Heede's original research was groundbreaking in that it tied significant fractions of global emissions to individual companies or state actors. Now, UCS, CAI, and Oxford have demonstrated that scientists (and plaintiffs) can trace the contributions of individual companies to climate impacts and climate-related disasters. While the specific mathematic conclusions may be challenged, the fact that this research and methodology passed the muster of peer review demonstrates that it is possible to apportion percentages of specific climate impacts to individual companies.

But establishing that major carbon producers are causally contributing to climate impacts and climate harms is only the first step in accountability. The question remains: Can they be held responsible?

The Fundamental Elements of Responsibility: Notice of Risk and the Opportunity to Avoid or Reduce Risk

While establishing causal links between a defendant's actions and a plaintiff's harms is a necessary condition of liability in most circumstances, it is rarely sufficient. There are certain areas of law and certain legal concepts—such as strict liability—

This research and methodology demonstrates that it is possible to apportion percentages of specific climate impacts to individual companies.

under which proof of causation alone will trigger liability. Far more generally, however, as a matter of fairness, morality, and of law, judicial bodies seek evidence that a defendant not only caused a harm, but that they were culpable for that harm in some way—that the defendant acted (or failed to act) in a way that renders them morally responsible for addressing—and remedying—the consequences of those actions.

As ethicist Henry Shue explains in an essay that accompanied the foregoing paper:

If A falls down the escalator because she is hit from behind by B, but B was tripped by C, B is partly causally responsible but not at all morally responsible for A's fall. The moral responsibility for A's fall belongs entirely to C. Causal responsibility must be blameworthy to become the basis for moral responsibility, and causation—or "contribution"—is blameworthy only if it is a violation of a socially accepted principle.¹⁴



Both tort law and international human rights law are rooted in this underlying concept of responsibility. The legal analysis presented in this section is not intended to prove the elements of particularized claims, but rather to distill the core components of responsibility in the areas of tort law, human rights law, and products liability. When determining whether someone can be held liable for a harm—and assuming the burden of showing causation has been met—tort law and human rights law both converge on two core elements of responsibility: An actor is responsible for a harm when they have 1) the ability to foresee a harm, and 2) the ability and opportunity to avoid or minimize that harm.

As Justice Oliver Wendell Holmes of the US Supreme Court observed, tort liability may be properly imposed when the harm in question was both reasonably foreseeable and avoidable.¹⁵ Legal philosopher H.L.A. Hart reiterated these two criteria, namely, the capacity to foresee the harm and the ability to avoid the harm, as both necessary and sufficient conditions for responsibility for harmful outcomes.¹⁶

Professor Stephen R. Perry of the University of Pennsylvania School of Law distills these elements into an “outcome-responsibility” theory of tort liability. As Perry explains, an actor agent “is outcome-responsible for a harmful outcome if and only if he causally contributed to it, possessed the capacity to foresee it, and had the ability and opportunity to take steps, on the basis of what could have been foreseen, to avoid it.”¹⁷

In a review of Hart and Perry, Goldberg & Zipursky affirm and further elaborate on the essential elements of responsibility. “A person is outcome-responsible for a loss if the person’s volitional action was a necessary condition for the loss’s having occurred, and if the loss was avoidable, in that the person could reasonably have foreseen that his action might cause the loss, and the person was capable of acting so as not to cause it. Critically, for any



© PublicDomainPictures/Pixabay

given loss, there can be more than one outcome responsible actor[.]”¹⁸ Both Perry and Goldberg & Zipursky extend this theory to include the sale of products. When someone who produces or markets a particular product has the ability to foresee certain potential harms to flow from that product, this risk of harm gives rise to an obligation to

Both tort law and international human rights law are rooted in this underlying concept of responsibility.

undertake further research. Perry observes that, “the company that negligently fails to carry out appropriate further research [is] outcome-responsible for the harms that result from releasing its product onto the market[.]”¹⁹ Goldberg & Zipursky are even more explicit, concluding that “[a] seller can cogently be deemed morally responsible for its product having caused an injury when the injury was an avoidable consequence of selling the product.”²⁰

Corporate Responsibility for Human Rights Violations Arising from Climate Change

In light of this analysis, the parallels between responsibility under tort and civil law, and the essential elements of responsibility for human rights violations become clear. Accordingly, we find the same elements reflected in the work of human rights bodies and mandate holders.

In its treatise on “Corporate Complicity & Legal Accountability,” the International Commission of Jurists explicitly addressed the fundamental tenets of responsibility underlying the laws of tort in common law jurisdictions, of “non-contractual obligations” in civil law countries, and the law of human rights.²¹ Recognizing the growing importance of civil liability in assuring corporations are held accountable for their role in human rights violations, and further recognizing that laws of civil liability and human rights protect similar fundamental interests, the Commission undertook a comparative analysis of laws of tort and civil liability across countries, and explored “the ways in which, across jurisdictions, civil liability may arise for



© tadtography/Pixabay

companies and/or their officials when they are complicit in gross human rights abuses.”²²

The Commission distilled the principles of civil liability—i.e. responsibility—into four basic questions, which it found equally applicable to determining whether companies were complicit in gross human rights abuses:

- Was harm inflicted to an interest of the victim that is protected by law?
- Did the company’s conduct contribute to the infliction of the harm?
- Did the company know or would a prudent company in the same circumstances have known that its conduct posed a risk of harm to the victim?
- Considering this risk, did the company take the precautionary measures a prudent company would have taken in order to prevent the risk from materializing?²³

These questions are, ultimately, asking the same questions outlined in the three factors above: foreseeability, causation, and ability to avoid.

In 2011, UN Special Rapporteur on Business & Human Rights John Ruggie addressed the human rights responsibilities of corporations in his

report *Guiding Principles on Business and Human Rights*.²⁴ These “Ruggie Principles,” as they have become known, have been endorsed by the UN Human Rights Council as the foundation for assessing corporate responsibilities to uphold human rights and avoid complicity in human rights violations.²⁵

These companies bear responsibility for climate change and have an opportunity—and obligation—to contribute to solutions.

The Ruggie Principles ground the corporate responsibility to protect human rights in both substance and process.²⁶ Substantively, there are a suite of human rights that corporations must not violate.²⁷ Procedurally, corporations must implement human rights due diligence systems, including the adoption of human rights policies, production of impact assessments, and tracking company performance.²⁸

Under the principles, corporations are held to a standard of upholding human rights. (To violate those rights would constitute a harm.) They are obligated to investigate and monitor the circumstances of their operations, and therefore should be on notice of violations of human rights. (The harms should be foreseeable,

and therefore avoidable.) Finally, the extent of human rights obligations owed by corporations is limited to potential and actual human rights impacts resulting from a company’s business activities and relationships connected to those activities.²⁹ (There is a causal relationship between the actor and the harm.)

This framework of elements—ability to foresee a harm, ability to avoid the harm, and a causal link between the actor and the harm—as the basis for responsibility can be applied to the behavior of individual fossil fuel companies, as well as the sector as a whole. As detailed in the pages that follow, there is now extensive evidence that the world’s largest investor-owned oil companies—also among the largest of the major carbon producers identified by Heede and others—knew or should have known about the reality of climate change, and the fact that it was caused primarily by the combustion of fossil fuels, more than a half century ago.

A 2015 essay by Peter Frumhoff, Richard Heede, and Naomi Oreskes explicitly addresses the issue of industrial carbon producers’ responsibility for climate change.³⁰ The authors conclude both that these companies bear responsibility for climate change and that they have the ability, and obligation, to contribute to solutions.³¹

Oxford’s Henry Shue drew the same conclusion in considering the moral responsibility of major carbon producers. Shue concluded:

Unless carbon producers are somehow exempt from the moral principles that society applies to ordinary mortals, their 50 years of flagrant disregard of their simple negative responsibility to do no harm, beginning by reducing any initially unavoidable harm as rapidly as possible through either modification of or substitution for their products, brings to bear the other basic principle that is the other side of the same coin: clean up your own mess.³²

PART 2

The Evidentiary Basis for Accountability

Notice, Opportunity, and Failure to Act

Oil on Notice: Evidence of Early Industry Awareness of Climate Risks

The potential link between fossil fuel combustion and atmospheric temperature increase has been widely discussed in scientific literature and academic texts relevant to the oil industry for more than a century.

The earth receives a constant stream of radiant energy from the sun. This solar radiation is critical to maintaining planetary temperatures at a level that will support life. It has been equally critical to life and to a stable human civilization that a significant portion of the radiation the earth receives from the sun is reflected back into space, thus ensuring that planetary temperatures do not increase uncontrollably. Beginning with the work of John Tyndall in 1859, it has been widely recognized that certain “greenhouse gases,” such as carbon dioxide, make the Earth’s atmosphere more opaque to that reflected radiation, trapping energy that would otherwise be released back into space.³³ At the same time, scientists and industry experts alike have long recognized the simple and irrefutable fact that the combustion of fossil fuels—including coal, oil, and natural gas—releases tremendous amounts of carbon dioxide (CO₂) into the atmosphere; and that, indeed, CO₂ is by far the largest waste stream from fossil fuel combustion processes.³⁴

The proportion of carbon dioxide in the atmosphere has a strong positive correlation with planetary temperatures. For more than a century, this relationship between carbon dioxide and planetary



temperatures has been routinely discussed in scientific literature, including specialist journals and textbooks for the geology

The potential link between fossil fuel combustion and atmospheric temperature increase has been widely discussed in scientific literature and academic texts relevant to the oil industry for more than a century.

and mineralogy communities, in the general and popular scientific press, and even in newspaper reports.³⁵ For decades, however, the relationship between fossil fuel combustion, atmospheric CO₂, and global temperatures caused little concern because it was widely, but erroneously, assumed that the CO₂ released in this way would be safely absorbed by the world’s oceans, thus reducing global climate impacts.

This situation began to change, and scientific attention to carbon dioxide began to intensify, when researcher Guy Callendar published a study entitled *The Artificial Production of Carbon Dioxide and its Influence on Temperature*.³⁶ In his study, Callendar observed that three quarters of the carbon dioxide released in the prior 50 years had, in fact, remained in the atmosphere. As a result, Callendar estimated world temperatures had increased at 0.005°C per year for the previous fifty years.³⁷

Callendar’s study was not immediately embraced, but it was widely cited and debated over the following two decades.³⁸ Some, such as Giles Slocum of the US Weather Bureau, determined that they could not detect a noticeable change in atmospheric carbon dioxide concentrations.³⁹ Others postulated that the oceans would absorb so much of the carbon dioxide that “the amount of

surplus CO₂ from artificial coal combustion will become insignificantly small as soon as equilibrium with marine carbonate is established.”⁴⁰ In 1955, however, Hans Suess provided the first clear proof that, as hypothesized in 1896 by Svante and theorized by Callendar, carbon dioxide traceable to the combustion of fossil fuels was accumulating in the atmosphere,⁴¹ a phenomenon that would thereafter be referred to as the “Suess effect.”

The research of Callendar, Slocum, Suess, and others was neither obscure nor hidden. Unsurprisingly, the earliest industry studies to which we have access that measure the buildup of carbon dioxide in the atmosphere appear around this time.

Documentary Evidence Demonstrates Oil Industry was on Notice of Potential Climate Risks by 1957

In 1957, Suess and Roger Revelle, of the Scripps Institute of Oceanography in La Jolla, California, published a landmark paper that contradicted the longstanding assumption that the oceans would absorb a large majority of artificial carbon dioxide added to the atmosphere.⁴² Revelle and Suess predicted large increases in atmospheric carbon dioxide, especially if fossil fuel combustion continued to increase exponentially.⁴³ They noted that “[w]ithin a few centuries we are returning to the atmosphere and oceans the concentrated organic carbon stored in sedimentary rocks over hundreds of millions of years.”⁴⁴ Two months after the Revelle and Suess paper was published, scientists at Humble Oil (now ExxonMobil) submitted their own study for publication on the same question.⁴⁵

Significantly, the Humble Oil study acknowledges not only rising levels of atmospheric CO₂, but also the evident contribution of fossil fuels to that increase and the continuing and projected rise in that fossil fuel combustion.⁴⁶ In acknowledged disagreement with Revelle, however, the paper suggests that CO₂

would be retained in the oceans much longer before returning to the atmosphere, which would delay the impact of fossil fuel emissions by decades or centuries.⁴⁷

The Revelle and Suess study did not warn that climate change would definitely devastate the planet, but it did emphatically state that atmospheric carbon dioxide levels were likely to increase significantly over the following several decades. Moreover, the report

“[W]ithin a few centuries we are returning to the atmosphere and oceans the concentrated organic carbon stored in sedimentary rocks over hundreds of millions of years.”

— HANS SUESS & ROGER REVELLE, 1957

provides definitive evidence that, by 1957, at least one oil company—a subsidiary of Standard Oil of New Jersey (now ExxonMobil)—was aware that the byproducts of fossil fuel combustion were accumulating in the atmosphere and would likely continue to do so.

An internal account of industry-funded research projects in 1958 indicates that at least one project funded by the American Petroleum Institute (API) was measuring the proportion of atmospheric carbon “of fossil origin,” i.e., the Suess effect.⁴⁸ Funded under the auspices of the American Petroleum Institute’s Smoke and Fumes Committee, the research into atmospheric carbon was part of a broader research program targeting atmospheric pollutants of concern to the oil industry as a whole. This history provides clear documentary evidence that key oil and gas industry actors were collaborating in and through API to investigate carbon dioxide as an atmospheric pollutant by no later than 1958. As discussed more fully below, they were doing so within the context of a longstanding campaign to combine industry-funded science with active public relations efforts to increase public skepticism of air pollution science and regulation.

The Petroleum Industry Engaged in Coordinated Research and Communications on Air Pollution Issues from the 1940s Onward

The petroleum industry has long been highly coordinated, acting through centralized industry associations. The Western Oil and Gas Association (WOGA)—now the Western States Petroleum Association (WSPA)—was founded in 1907 and represents petroleum companies in the western United States.⁴⁹ The American Petroleum Institute was created in 1919 to represent the American petroleum industry as a whole.⁵⁰ From the time API was founded, oil companies recognized pollution issues as an area of significant common concern, and by the 1930s, they had focused particularly on the industry’s shared concerns with air pollution and the related public hostility and risk of regulation it presented.

In the 1940s, Los Angeles, California, grappled with increasingly severe and debilitating smog. In late 1946, executives from the major petroleum companies represented by WOGA established the “Committee on Smoke and Fumes of the Western Oil and Gas Association” to fund research into the causes of air pollution in Southern California.⁵¹ The committee was explicitly created not just to conduct research, but also to communicate that research to the media, public, and decision makers with the express goal of discouraging pollution regulations the industry deemed costly and unnecessary.⁵²

A report on the Committee’s work by Esso (now ExxonMobil) executive G.A. Lloyd highlighted the central role that understanding and shaping public opinion played in the work and the objectives of the Smoke and Fumes Committee. Highlighting that an “Information Committee” populated with public relations representatives was a key part of the enterprise, Lloyd outlined their key priorities. The highest of these priorities was to collect, evaluate, and

integrate information not only on key air pollutants of interest to the industry, but also on “the attitudes of the general public on these problems, *and the activities of individuals or groups seeking to achieve objectives in this field.*”⁵³ It sought to ensure, through API, that information relevant to air pollutants and their regulation flowed continuously to key oil industry personnel, and, critically, to assist industry leaders in “preparing statements on controversial issues.”⁵⁴ As explained by Lloyd, the Smoke and Fumes Committee actively pushed out its messages through articles in national magazines, outreach to reporters, leaflets and brochures, and issuing running progress reports on the industry’s pollution control efforts.⁵⁵

The early history of the Smoke and Fumes Committee, and particularly its engagement on the smog debate in California, offers insight into the context in which early oil industry research into climate change was undertaken.

In 1946, the year that the Smoke and Fumes Committee was founded, the Stanford Research Institute (SRI) was founded in connection with Stanford University.⁵⁶ One written history of SRI indicates that Atholl McBean, director of Standard Oil of California (now Chevron) was the “most important of the founding fathers.”⁵⁷ In 1947, the Smoke and Fumes Committee hired the newly-created SRI to conduct much of its air pollution research.⁵⁸ Indeed, in its early years, 74% of SRI’s research “went to petroleum and natural gas people,”⁵⁹ and oil and gas interests were heavily represented on its board. In 1952, the Smoke and Fumes Committee was reformed within API, with an executive of Union Oil Company of California (now Chevron) as its chairman.⁶⁰

As noted above, the Smoke and Fumes Committee existed not just to fund and oversee research, but to actively communicate with “interested organizations in industry, research, and government; and to the public.”⁶¹ However, as the goal of the Smoke and

Fumes Committee was, in part, to avoid “the hasty passage of a law or laws for the control of a given air pollution situation,”⁶² the Committee did not simply publish all the research it sponsored. One stark example of this pattern unfolded in the debate over the causes of urban smog.

By the early 1950s, scientist Arie Haagen-Smit had identified automobiles and gasoline as the primary causal agents for the pervasive smog pollution that choked Southern California in a toxic haze for decades. After California regulators accepted Haagen-Smit’s theory, the Smoke and Fumes Committee launched an extensive campaign to discredit Haagen-Smit and his research. When an atmospheric chemist named Harold Johnston publicly criticized Haagen-Smit’s theory, the Smoke and Fumes Committee awarded Johnston a contract with SRI to review Haagen-Smit’s work and disprove his theory.⁶³ Unexpectedly, Johnston’s work confirmed Haagen-Smit’s research was correct, with Johnston himself proclaiming Haagen-Smit a “genius.”⁶⁴ When Johnston shared his findings with superiors at SRI, his

presentation to the SRI board of directors was postponed, and his consultancy terminated.⁶⁵

In 1954, when Vance Jenkins recounted the history of industry-sponsored air pollution research to the public, he neglected to mention Johnston’s confirmation of Haagen-Smit’s theory and declared “[t]he work at Stanford Research Institute has shown that there are a number of apparent errors both in this theory and in its interpretation to account for the various phenomena associated with smog.”⁶⁶ The experience of Haagen-Smit was indicative of the Smoke and Fumes Committee’s work on a number of fronts, and its frequent use of industry-funded researchers to question or contradict air pollution research it considered unfavorable to industry interests.

By 1958, the Smoke and Fumes Committee was funding research into an array of pollutants at a number of additional institutes, including Armour Research Foundation, Franklin Institute, and Truesdail Laboratories.⁶⁷



In 1965, the Smoke and Fumes Committee merged with other API committees and working groups to form the Committee for Air and Water Conservation (CAWC) of the American Petroleum Institute.⁶⁸ The CAWC consisted of “representatives from 20 API member companies,” while “major oil industry associations also send liaison representatives to CAWC meetings.”⁶⁹

“The oil industry is several years ahead of the other American industries in applying meteorology and oceanography.”

— A.H. GLENN, 1951

The Industry Undertook Coordinated Research into Many Subjects Relevant to the Causes and Impacts of Climate Change

When the major petroleum companies began expanding their operations offshore into the Gulf of Mexico in the 1940s, they realized that hurricanes posed a significant challenge to the safe and reliable operation of offshore oil rigs. In 1947, Humble Oil (now ExxonMobil) contracted with A.H. Glenn, a meteorological consultant, to develop wave and weather forecasting techniques.⁷⁰ In a paper from 1951,

Glenn notes that “the oil industry is several years ahead of the other American industries in applying meteorology and oceanography.”⁷¹ He further comments that even the government’s own services in the space are too broad for industry needs and typically trail industry’s own science by years.⁷²

In 1956, API initiated a research program that would last until 1962 to investigate the causes of, and conditions preceding, hurricane formation.⁷³ Mercer Parks, the chairman of the program from Humble Oil, wrote a retrospective account of the project in 1963 where he outlined the advances made in the ability to predict hurricane formation based on current weather conditions.⁷⁴ Another paper by M.M. Patterson, of Shell Development Company, describes a then-ongoing eighteen-month project to collect ocean data from newly installed Shell oil platforms “for the development and calibration of environmental forecasting theories.”⁷⁵ This joint project included participation from several major petroleum companies, including Shell Development Company, Esso Production Research Company (now ExxonMobil), Mobil Research and Development Company (now ExxonMobil), Pan American Petroleum Corporation (now BP), Gulf Oil Corporation, Texaco Inc., the CAGC Marine Region, and Chevron Oil Field Research Company.⁷⁶

In addition to their research into hurricane formation, many of the major oil companies conducted research into paleoclimates and historical sea levels, to better predict where reserves of offshore oil may be found. Research into the historical temperature record was sponsored by API in 1950,⁷⁷ and radiocarbon dating was being done at Humble Oil laboratories by 1957.⁷⁸

This research was undertaken against a backdrop of modest but growing awareness of the relationship between climate change and extreme weather events. In 1956, the *Madera Daily News* ran an article, “Carbon Dioxide May Contribute to Hurricanes,” which

EXHIBIT 1

Excerpt from 1954 Report for Smoke & Fumes Committee

Panicky People

The worst thing that can happen, in many instances, is the hasty passage of a law or laws for the control of a given air pollution situation. For in many such cases their passage results from a panicky feeling that “there ought to be a law” and laws drawn for such reasons are likely to be poorly drawn and based on either insufficient or erroneous data.

But once a law is on the statute books, there is a tendency for those who were in such a panic to get it there to relax and wait for the miracle it was to bring about to occur. But, as a rule, nothing happens, for the mere existence of even a very poor law that is supposed to solve a problem tends to inhibit further thought on the problem.

And, unfortunately, in such cases, further thought is exactly what is needed. That is why that passing a law is, in many cases, the wrong way to start about solving an air pollution problem. And passing the wrong law can also often be the most expensive and irritating way to approach the problem as far as both the public and industry are concerned.

At the end of the First World War in 1918, the petroleum industry executives serving on the President’s War Advisory Committee on Petroleum agreed that their cooperative efforts in behalf of the industry should continue.



© Wikimedia/Pixabay

discussed Revelle's ongoing work and explained the theory that accumulating carbon dioxide in the atmosphere might be raising temperatures and contributing to an intensification of hurricanes.⁷⁹ The same year, an article in *Time Magazine* noted Revelle's work and warned that rising temperatures could "melt the icecaps of Antarctica and Greenland, which would flood the earth's coastal lands."⁸⁰ As experts in the science relevant to their products, it can be presumed that the oil and gas industries knew or should have known about these public discussions and the relevant science

If anyone would have understood how fossil fuel combustion and global warming were going to change the climate, it was this industry.

underlying them.

In addition to studying the natural behavior of hurricanes, the oil industry also sponsored research into weather modification techniques. In the 1960s, for example, James Black of Esso—who would later warn Exxon executives of the dangers of rising carbon dioxide levels in the atmosphere—researched and patented techniques to trap heat and manipulate local weather conditions by covering large areas in asphalt.⁸¹ M.L. Corrin, a

consultant to Philipps Petroleum, and C.A. Stokes of Cities Service (now CITGO) co-authored a book-length report on the use of petroleum-based carbon dust in weather modification techniques at multiple geographic scales.⁸²

Finally, the oil industry, for its own business motives, had a deep and profound understanding of the relationships between sea levels, atmospheric temperatures, and carbon in the environment. In 1961, for example, API funded a study into the trends in sea level from 30,000 years before present to 7,000 years before present. The author discussed the relationship between the size of glaciers, global temperatures, and sea level, noting specifically that a rapid rise in sea level coincided with a warming of the climate. "Sea level, on the other hand, rises during warm periods and falls during cold periods[.]"⁸³ If anyone would have understood how fossil fuel combustion and global warming were going to change the climate, it was this industry.

It is clear that the *purpose* of the previously described research into hurricanes, sea level, and paleoclimate was not to investigate climate change, but rather to determine where to explore for oil. However, these research priorities armed the petroleum industry with

cutting-edge knowledge about changes in sea levels and hurricanes, two natural phenomena implicated by climate change.

The idea that accumulating carbon dioxide in the atmosphere could lead to increased hurricane formation and rising sea levels was being discussed openly in newspapers and magazines as early as 1956. While we cannot know for certain that the entire industry was aware of these theories, they had as much expertise in the field as any other industry, academia, or the government. Moreover, scientists hired by API explicitly connected temperatures, glaciers, and sea levels in research paid for by API. Given the advanced knowledge and expertise, it is fair to ask whether the major oil and gas companies, and the petroleum industry as a whole, knew or should have known about the emerging science focused on the relationship between fossil fuel combustion, global temperatures, sea levels, and extreme weather events.

The Petroleum Industry was Unequivocally Warned of Climate Change Due Primarily to the Combustion of Fossil Fuels By 1968

In 1968, a report from the Stanford Research Institute called *Sources*,

Abundance, and Fate of Gaseous Atmospheric Pollutants was delivered to W.A. Burhouse,⁸⁴ Assistant Director of API's Committee for Air and Water Conservation, the successor to the Smoke and Fumes Committee.⁸⁵ Authored by SRI scientists Elmer Robinson and R.C. Robbins, the report addressed six pollutants, including carbon dioxide.⁸⁶ It cautioned that rising levels of CO₂ would likely result in rising global temperatures and that, if temperatures increased significantly, the result could be melting ice caps, rising sea levels, warming oceans, and serious environmental damage on a global scale.⁸⁷ The scientists acknowledged that burning fossil fuels provided the best explanation for rising CO₂. They further recognized that existing science was "detailed" and seemed "to explain adequately the present state of CO₂ in the atmosphere."⁸⁸

The 1968 report from SRI did not state definitively that there was a scientific consensus on questions of climate, but concluded "[s]ignificant temperature changes are almost certain to occur by the year 2000 and these could bring about climatic changes."⁸⁹ Robinson and Robbins cautioned that these increased temperatures could result in melting ice caps, rising sea levels, warming oceans, and environmental damage on a global scale.⁹⁰

In assessing future research needs with respect to CO₂, Robinson and Robbins acknowledged that fossil fuel combustion provided the best explanation for rising carbon dioxide levels. More significantly, they concluded that:

Past and present studies of CO₂ are detailed and seem to explain adequately the present state of CO₂ in the atmosphere. What is lacking is an application of these atmospheric CO₂ data to air pollution technology and work toward systems in which CO₂ emissions would be brought under control.⁹¹

By no later than 1968, therefore, API and its industry members were being warned by their own scientific consultants that the links between fossil fuel combustion and rising atmospheric CO₂ were credible; that temperature rise was almost certain to result; and that the most pressing research need was into technologies to address and control the release of carbon dioxide into the atmosphere from the burning of fossil fuels. Although API quickly embraced other aspects of the Robinson and Robbins report, API asked SRI to review their findings on CO₂ more extensively in a Supplemental Report submitted in 1969.⁹² This document had not yet been obtained when CIEL initially published

its Smoke and Fumes database in 2016, and it has not previously been reported by other sources. Accordingly, and in view of its early extensive treatment of climate issues, it is discussed at length here.

Unlike the original paper, the majority of SRI's 1969 supplemental report focused on only two pollutants, one of which was atmospheric carbon dioxide. This supplement repeated and further substantiated most of the core conclusions of the prior report, including its recognition that: atmospheric concentrations of carbon dioxide were steadily increasing; 90% of this increase could be attributed to fossil fuel combustion; and continued use of fossil fuels would inevitably and inexorably result in greater CO₂ levels in the atmosphere. They reviewed the role of plant growth and of oceans both as sources of and as natural sinks for carbon dioxide. They found it unlikely that either changes in marine biomass or other natural changes in the biosphere could be responsible for rising CO₂ levels, and further concluded that neither of these natural sinks could keep pace with the excess emissions created by burning fossil fuels. As a result, Robinson and Robbins estimated that the projected growth in fossil fuel use would push atmospheric CO₂ to 370 ppm by the year 2000. This estimate proved remarkably accurate.⁹³

In their Supplemental Report to API, Robinson and Robbins acknowledged that the increase in atmospheric CO₂ was of potential concern because of how it would affect the radiation balance of the earth. They discussed at length, and with approval, modeling done by Manabe and Weatherald, and estimated that on the basis of those models, an increase in CO₂ to 370ppm would increase global temperatures by 0.5 C (0.9 F) by the year 2000. Again, Robinson and Robbins' estimate proved remarkably accurate; between 1965 and 2000, long-term average global temperatures increased by approximately 0.5 C.⁹⁴ They estimated that at 600 ppm, temperatures would rise by 2.36 C (4.2 F),⁹⁵ while also

EXHIBIT 2

Excerpt from 1969 Supplemental Report to API

It is rather obvious that we are unsure as to what our long lived pollutants are doing to our environment; however, there seems to be no doubt that the potential damage to our environment could be severe.

Whether one chooses the CO₂ warming theory as described by Revelle and others, or the newer cooling theory indicated by McCormick and Ludwig, the prospect for the future must be of serious concern.

It seems ironic that, in air pollution technology, we are so seriously concerned with small scale events, such as the photochemical reactions of trace concentrations of hydrocarbons and the effect on vegetation of a fraction of a part per million of SO₂, whereas the abundant pollutants--CO₂ and submicron particles--which we generally ignore because they have little local effect, may be the cause of serious worldwide environmental changes.

recognizing that the combustion of all then recoverable fossil fuels would raise atmospheric CO₂ to 850 ppm, driving global temperatures still higher.

Robinson and Robbins acknowledged the widespread inference in the available science that “a given increase in atmospheric temperature could cause a gradual melting of the polar ice caps” and that this melting, if it occurred, “would obviously result in inundation of coastal areas.”⁹⁶ They also acknowledged a long-term, detailed study that had indeed found apparent relationships between Antarctic ice caps and the global climate. Remarkably however, and in stark contrast to their treatment of other issues and the warnings of their earlier report, Robinson and Robbins summarily disregarded these findings and their implications, on the grounds that they were “based on what has occurred in the past, and with our present knowledge we are not justified in predicting future effects of CO₂ based on these correlations.”⁹⁷ The Supplement omits several paragraphs from the earlier report summarizing the potential environmental and human impacts of climate change.

Despite this professed uncertainty, Robinson and Robbins summarized by reiterating, “On the basis of our present knowledge, significant temperature changes could be expected to occur by the year 2000 as a result of increased CO₂ in the atmosphere. These could bring about long term climatic changes.”⁹⁸ They repeated their earlier warnings that “there seems to be no doubt that the potential damage to our environment could be severe ... [and that] the prospect for the future must be of serious concern.”⁹⁹ They marked again the irony that the abundant pollution by carbon dioxide and particulate matter, “which we generally ignore because they have little local effect, *may be the cause of serious worldwide environmental changes.*”¹⁰⁰ Perhaps for this reason, the Supplemental Report did not revisit or alter the Research Needs identified in the original report.



© gihart39/pixabay

Finally, and notably, the Supplemental Report included two paragraphs of “Summary and Conclusions” with respect to CO₂. The first of these paragraphs briefly and accurately summarized the report’s findings with respect to rising CO₂ levels, the role of fossil fuel combustion, and the likelihood that atmospheric CO₂ would continue to grow as fossil fuel use continued. In stark contrast to the body of the report (and to the 1968 original), however, the second summary paragraph downplayed the potential implications of that increase for global temperatures, sea levels, and the environment—focusing exclusively on the uncertainties that made it impossible to draw any conclusions.¹⁰¹ We know that industry scientists were aware, or should have been aware, of Robinson and Robbins’ reports for two reasons. First, an internal API document titled *Environmental Research, A Status Report*, published in January 1972, outlines all of the research funded by CAWC up to that point in 1972.¹⁰² The status report acknowledges both the original 1968 SRI report and the 1969 Supplemental Report, including explicit references to the discussions of carbon dioxide contained therein.¹⁰³

Second, the National Petroleum Council (NPC) submitted a report to the Department of Interior in 1972 entitled *Environmental Conservation: The Oil and Gas Industries*.¹⁰⁴ An advisory body

populated and funded by the petroleum industry, the NPC advises the federal government on questions that concern the industry.¹⁰⁵ High-level executives from across the oil and gas industry were expressly listed as authors and editors of the 1972 report and of its component chapters, including an extensive chapter on “Air Pollution.”¹⁰⁶

By no later than 1968, the petroleum industry as a whole was on notice of climate change, its most probable causes, its potential risks, and the pressing need to research technologies to reduce carbon dioxide emissions.

In its chapter on air pollutants, the 1972 NPC report acknowledges Robinson & Robbins’ report, describing it as a “careful study” by “eminent scientists” and as an authoritative source on atmospheric pollution.¹⁰⁷ The report draws heavily from every aspect of Robinson and Robbins’ work, with the conspicuous exception of its section on carbon dioxide. That NPC addressed carbon dioxide as an atmospheric pollutant, but did not reference either version of the SRI report the industry itself had commissioned. Instead, it relied almost entirely on a 1965 publication from the American Association for the Advancement of Science called *Air Conservation*.¹⁰⁸ The four-page section in



© tekils918/Pixabay

Air Conservation on carbon dioxide—reproduced almost entirely in the NPC report—was dramatically shorter, less detailed, considerably more equivocal than the industry’s own 1968 report, and failed to mention Revelle’s landmark paper from 1957, as well as several other leading assessments.¹⁰⁹

The Robinson and Robbins reports, read in conjunction with explicit references thereto in an industry-authored 1972 report demonstrates that by no later than 1968, the petroleum industry as a whole was on notice of climate change, its most probable causes, its potential risks, and the pressing need to research technologies to reduce carbon dioxide emissions.

From 1977 to 1982 Exxon Scientists Repeatedly Confirm the Science of Climate Change

Investigations and document releases have demonstrated that, by no later than the late 1970s, scientists employed by Exxon were reiterating to top management both

the degree of certainty within the science and the scale of possible impacts. In 1977, Exxon scientist James Black informed the company’s management committee that climate change driven by fossil fuel use posed a significant global threat.¹¹⁰ Later that same year, an inter-office memo from Henry Shaw, another Exxon scientist, noted that the “CO₂ problem ... is the most important man-made weather problem that we have to contend with.”¹¹¹ In May 1978, Black gave a presentation that included a prediction that a doubling of CO₂ in the atmosphere would produce a temperature increase of two to three degrees Celsius. He noted that, despite any uncertainties about the state of science at the time, “there is no guarantee that better knowledge will lessen rather than augment the severity of the predictions.”¹¹² He reiterated that the growth in carbon dioxide in the atmosphere was due primarily to fossil fuel combustion, and he concluded that “man has a time window of five to ten years before the need for hard decisions

regarding changes in energy strategies might become critical.”¹¹³

By 1980, the scientific consensus was being openly acknowledged by Exxon scientists. Exxon’s December 1980 Technological Forecast warned that “most widely accepted calculations carried on thus far on the potential impact of a doubling of carbon dioxide on climate indicate that an increase in the global average temperature of $3 \pm 1.5^{\circ}\text{C}$ is most likely ... with greater warming occurring at the ... polar regions.”¹¹⁴ The forecast also noted that projections calculating smaller temperature increases “are not held in high regard by the scientific community.”¹¹⁵ Documentary evidence demonstrates that similar findings were being presented to and discussed within API as a whole.¹¹⁶

This understanding was also communicated in a 1980 report from Imperial Oil, Exxon’s Canadian subsidiary, entitled *Review of Environmental Protection Activities for*

“[M]an has a time window of five to ten years before the need for hard decisions regarding changes in energy strategies might become critical.”

— JAMES BLACK, 1978

1978-1979. The report acknowledges “[t]here is no doubt that increases in fossil fuel usage and decreases in forest cover are aggravating the potential problem of increased CO₂ in the atmosphere.”¹¹⁷ Significantly, the memo expressed the view that Exxon possessed the technology to dramatically reduce emissions, but that doing so would result in an unacceptable increase in costs.

By 1981, Exxon had internally acknowledged the risks of climate change and the role fossil fuel combustion played in increasing carbon dioxide concentrations in the atmosphere. A position memo from Henry Shaw in May 1981 includes as Exxon’s current position on the CO₂ greenhouse effect that a three degree increase in average temperatures will result in a ten degree increase at the poles, “[m]ajor shifts in rainfall/agriculture,” and that “[p]olar ice may melt.”¹¹⁸

By 1982, any lingering doubts were put to rest by a memo from Roger Cohen, then Director of Exxon’s Theoretical and Mathematical Sciences Laboratory. In this memo, Cohen noted that “a clear scientific consensus had emerged regarding the expected climatic effects of increased atmospheric CO₂.”¹¹⁹ This consensus determined that doubling

“[In] summary, the results of our research are in accord with the scientific consensus on the effect of increased atmospheric CO₂ on climate.”

— ROGER COHEN, 1982

atmospheric CO₂ would result in a global temperature increase of three degrees Celsius, plus or minus 1.5 degrees

Celsius.¹²⁰ In this memo, Cohen also acknowledged the work of a scientist who believed increased water evaporation and cloud cover would suppress global temperature increases. Cohen concluded, however, that this analysis was consistent with predictions that atmospheric temperature increases would be non-uniformly distributed across the globe, with little warming at the equator and greatest warming at the poles. He concludes that, “[in] summary, the results of our research are in accord with the scientific consensus on the effect of increased atmospheric CO₂ on climate.”¹²¹

Later that year, on November 12, 1982, Exxon circulated a 43-page climate change primer to several members of Exxon management to “familiarize Exxon personnel with the subject.”¹²² By this point, Exxon was fully aware and internally acknowledging that climate change was real, caused by burning fossil fuels, and would have significant impacts on the environment and human health and wellbeing.

As Early as the 1970s and No Later than the 1980s, Climate Change Projections Were Being Used in Business and Operational Planning

Internal documents uncovered by the *Los Angeles Times* and the Columbia School of Journalism demonstrate that by the mid-1980s, Exxon was incorporating climate change projections into its Arctic operations planning while discounting the risks when communicating with the public.¹²³

In 1986, a team of researchers led by Ken Croasdale of Imperial oil, an Exxon subsidiary, was “trying to determine how global warming could affect Exxon’s Arctic operations and its bottom line.” In 1991, Croasdale reported to an engineering conference that “[c]ertainly any major development with a life span of say 30-40 years will need to assess the impacts of potential global warming,” and that “[t]his is particularly true of

Arctic and offshore projects in Canada, where warming will clearly affect sea ice, icebergs, permafrost, and sea levels.”¹²⁴

Similarly, evidence uncovered by *The Guardian* demonstrates that Shell was also directly put on notice of climate risks and incorporating those risks into planning. A 1986 report seen by *The*

“Certainly any major development with a life span of say 30-40 years will need to assess the impacts of potential global warming... This is particularly true of Arctic and offshore projects in Canada, where warming will clearly affect sea ice, icebergs, permafrost, and sea levels.”

— KEN CROASDALE, 1986

Guardian addressed the issue directly. The report “notes the large uncertainties in climate science at the time but nonetheless states: ‘the changes may be the greatest in recorded history.’”¹²⁵

Later, in 1989, Shell Oil announced that it was redesigning a \$3 billion natural gas platform it had been designing for use in the North Sea.¹²⁶ The original design had the platform sitting 30 meters above the ocean’s surface, but the redesign would raise the platform by one to two meters to account for rising sea levels as a result of global warming.¹²⁷

This evidence of early action to protect industry assets from climate change should be considered a baseline for further investigation into both prior and subsequent industry conduct. Anecdotal evidence, including interviews with long-time industry insiders, strongly suggests the oil and gas industry may have begun accounting for climate change in the design of its own infrastructure far earlier than the 1980s. In a filmed interview with one of the authors of the present report, a long-time oil industry engineer reported that he had been instructed to plan for melting permafrost in the design and construction pads for the TransAlaska Pipeline in the early 1970s.¹²⁸ A second



© ambquinn/Pixabay

insider interviewed by a documentary film crew reportedly suggested that at least one oil company accounted for sea level rise in its design of offshore oil rigs even earlier.

Taken together, the available evidence demonstrates that by as early as the 1970s, and no later than the 1980s, not only was the entire petroleum industry on notice of climate change, but internal documents from two of the largest oil companies had confirmed and reaffirmed the reality of the problem. Moreover, at least two of the largest oil companies were actively incorporating expected changes into their engineering projects.

In the 1990s, Even as it Acknowledged Climate Realities Internally, the Oil Industry Intensified its Public Campaigns Against Climate Science

Even as they acknowledged climate realities internally, major oil companies continued and intensified their efforts to increase uncertainty regarding climate science and climate risks among the public and policymakers.

In 1990, a shareholder petitioned Exxon's board of directors to develop a plan to reduce carbon dioxide emissions from its operations facilities.¹²⁹ The board responded that its "examination of the

"The scientific basis for the Greenhouse Effect and the potential impact of human emissions of greenhouse gases such as CO₂ on climate is well established and cannot be denied."

— GLOBAL CLIMATE COALITION, 1995

issue supports the conclusions that the facts today and the projection of future effects is very unclear."¹³⁰ That same year, Exxon scientist Brian Flannery reportedly urged the first Intergovernmental Panel on Climate Change (IPCC) to emphasize the uncertainties surrounding climate models in its first Scientific Assessment Report.¹³¹

Beginning in 1989, Exxon, Mobil, Chevron, Shell, and BP, were instrumental in the creation and operation of the Global Climate Coalition (GCC).¹³² Throughout the 1990s, the GCC lobbied aggressively against action on climate change, not only within the United States but also at the international level. In briefings provided to policymakers and reporters, the GCC routinely asserted that "[t]he role of greenhouse gases in climate change is not well understood."¹³³ Internally, however, the GCC members acknowledged the reality of climate change, including the role of fossil fuels in climate impacts.¹³⁴ A 17-page "primer on global climate change science"

distributed to GCC members acknowledged that, "The scientific basis for the Greenhouse Effect and the potential impact of human emissions of greenhouse gases such as CO₂ on climate is well established and cannot be denied."¹³⁵

Despite this internal acknowledgement, the industry fought to undermine the legitimacy of the Second Assessment of the Intergovernmental Panel on Climate Change, specifically its conclusion about the human contribution to warming. Naomi Oreskes and Erik Conway outline how Ben Santer, one of the authors of the IPCC's Second Assessment, became the target of a coordinated industry campaign after leading the IPCC scientific team in the cautiously worded groundbreaking conclusion that "[t]he balance of evidence suggests that there is a discernible human influence on global climate."¹³⁶ While

"Victory Will Be Achieved When ... Average citizens 'understand' (recognize) uncertainties in climate science; recognition of uncertainties becomes part of the 'conventional wisdom.'"

— AMERICAN PETROLEUM INSTITUTE, 1998

noted denialist Fred Singer attacked the scientific conclusions, lobbyists for API and others accused Santer of altering the report itself and suppressing dissent.¹³⁷

The GCC, moreover, released a report accusing Santer and other IPCC scientists of revising the chapter, without authorization—despite the fact that the report hadn't yet been published.¹³⁸ This strategy of attacking scientists individually—echoing the experience of Arie Haagen-Smit in the fight over smog—presaged future attacks on scientists, such as Michael E. Mann, the lead author of the third IPCC report.¹³⁹

The stark dichotomy between the oil industry's internal understanding of climate change and its public communications on climate science and climate policy is manifest in an internal "Global Climate Science Communications Plan" prepared by the American Petroleum Institute in 1998. The plan, first brought to light by the Union of Concerned Scientists in 2007, outlined the industry's goals and strategies for engaging in the climate debate in the future.¹⁴⁰ It defined a successful industry campaign on climate change in the following language. "Victory Will Be Achieved When... Average citizens

'understand' (recognize) uncertainties in climate science; recognition of uncertainties becomes part of the 'conventional wisdom,'" and "[t]hose promoting the Kyoto treaty on the basis of extant science appear to be out of touch with reality."¹⁴¹

The Oil Industry Continued to Fund and Promote Climate Misinformation and to Oppose Climate Mitigation Actions Throughout the 2000s into the Current Decade

In 2000, ExxonMobil published an op-ed series entitled "Global Climate Change," which summarized the company's views on the issue. In one of the four op-eds, called "Unsettled Science," Exxon describes the science as inherently unsettled, questions whether changes in climate are due to human activities or natural variation, and suggests that uncertainties regarding climate impacts include *positive* uncertainties, for example about how much crop yields will increase and how much faster forests will grow.¹⁴²

The op-ed ends by declaring that, "while some argue that the science debate is settled and governments should focus only on near-term policies—that is empty rhetoric."¹⁴³

Documents discovered via Freedom of Information Act requests demonstrate that from 2001 through 2012 Wei-Hock Soon, a scientist at the Smithsonian Institution, received more than \$1.2 million in research funding from fossil fuel interests.¹⁴⁴ Major funders of Soon's work included ExxonMobil, API, the Charles Koch Foundation, and Southern Company.¹⁴⁵ That research was touted as independent, and the Smithsonian was disallowed from disclosing the identity of the funders without their permission.¹⁴⁶ As explained by the Union of Concerned Scientists, "Soon has written about many aspects of climate change but is best known for his work on the role of solar variability, research that has broadly overstated the role the sun plays in climate change and has been largely discredited by his scientific peers... Outcry from the climate science

BOX 1 Coal and Climate Denial

While oil companies have been among the largest and most consistent funders of climate denial and misinformation efforts, they have not been alone. Like their colleagues in oil and gas, the coal industry has a long, extensively documented history in promoting climate misinformation and denial.¹⁵⁰ In 1991, for example, the coal trade associations created the Information Council on the Environment, which orchestrated a national campaign publicly downplaying the risks of climate change.¹⁵¹ In 1998, the coal industry, through the Western Fuels Association, created "The Greening Earth Society" to promote the idea that rising levels of atmospheric CO₂ would benefit humanity and the planet by accelerating plant growth. The Greening Earth Society (GCC) was only one among many climate front groups operated or funded by the Western Fuels Association.¹⁵² They were also a part of the Global Climate Coalition, discussed elsewhere in this section.¹⁵³ Bankruptcy filings from three of the largest coal companies—Arch Coal, Alpha Natural Resources, and Peabody Energy—demonstrate that even after GCC was closed, these coal companies continued funding a network of "denier groups," including the Heartland Institute, the American Legislative Exchange Council, the Competitive Enterprise Institute, the Energy & Environmental Legal Institute, and the Free



Market Environmental Law Clinic.¹⁵⁴ In 2009, as the United States Congress was debating legislation designed to dramatically reduce greenhouse emissions nationwide, an alliance representing coal industry groups sent forged letters to members of Congress that falsely suggested several civil society groups opposed the legislation.¹⁵⁵



© MaxxGir/Pixabay

community over a 2003 paper published by Soon in *Climate Research* even resulted in the resignation of several of the journal editors and an admission by the journal's publisher that the paper should not have been accepted.¹⁴⁷

Leaked slides from a 2014 presentation from the Western States Petroleum Association (WSPA), the successor to the Western Oil and Gas Association, outline the strategy the industry used to oppose climate change reduction efforts in the state of California, which has the second highest greenhouse emissions of any US state.¹⁴⁸ WSPA members include BP, Chevron, ExxonMobil, Shell, and Occidental Petroleum. The slides reveal that WSPA organized 16 “AstroTurf” organizations—organizations with innocuous and grassroots-sounding names—to deploy industry messaging against proposed regulation under the guise of grassroots support.¹⁴⁹

More recently, as the reality of climate change has become all but impossible to deny, the largest companies have adjusted their strategies from outright denial to questioning the human contribution to climate change, the timing and severity of impacts, and the economic feasibility of

reducing emissions. In 2014, for example, ExxonMobil released a report entitled “Energy and Climate” which “provide[s] comments on the topics of global energy and climate change.”¹⁵⁶ In its discussion, ExxonMobil describes itself as believing “that changes to the earth’s climate, including those that may result from anthropogenic causes, pose a risk.”¹⁵⁷ Shell, in 2016, referred to fracking as a “future opportunity,” despite internal data from 1998 indicating that exploiting such reserves would be incompatible with climate goals.¹⁵⁸ Finally, as recently as January 2017, Rex Tillerson, who served as CEO of ExxonMobil until being nominated as US Secretary of State by Donald Trump, downplayed the risks of climate change during his confirmation hearing. “The increase in the greenhouse gas concentrations in the atmosphere are having an effect, our ability to predict that effect is very limited.”¹⁵⁹

In August 2017, Geoffrey Supran and Naomi Oreskes completed an analysis of 187 “climate change communications” produced by ExxonMobil between 1977 and 2014.¹⁶⁰ The team analyzed “peer-reviewed and non-peer-reviewed publications, internal company documents, and paid, editorial-style

advertisements (‘advertorials’) in *The New York Times*.”¹⁶¹ Their findings were clear: ExxonMobil misled the public, with a dramatic discrepancy between the certainties expressed in private and academic documents versus those shared with investors, consumers, and the general public.¹⁶² According to Supran and Oreskes, over 80% of internal and peer-reviewed documents acknowledge climate change as real and caused by humans, whereas only 12% of advertorials do—and over 80% express doubt.¹⁶³

A Systemic Problem

It’s critical to understand that the series of events presented above are not isolated incidents, but rather demonstrate a systemic, decades-long pattern of climate understanding, denial, and obstruction. Two recent developments in the understanding of Exxon’s behavior shed light on what we know, and how much more there is to discover.

New York State Attorney General Eric Schneiderman is currently investigating ExxonMobil to determine whether the company misled investors about the reality of climate change and its effects on

the world and the company.¹⁶⁴ This investigation has already revealed significant evidence of potential corporate malfeasance. For example, evidence from the investigation indicates that, for years, Exxon used a lower cost of carbon in internal calculations than the one it represented to investors and the public.¹⁶⁵

In June 2017, Schneiderman's office filed the transcript of an interview with Connie Feinstein, an information technology security and consulting manager at ExxonMobil, conducted as part of this investigation.¹⁶⁶ This transcript revealed that, as CEO of ExxonMobil, Rex Tillerson used a secret email address, under the alias "Wayne Tracker."¹⁶⁷ Not only was this email account secret, it was registered to Romana Helble, an IT manager at the company—ensuring there was no visible link between Tillerson and the account.¹⁶⁸ And, whereas Tillerson's official emails were preserved to accord with record preservation requirements, the secret account was subject to Exxon's file purge program, potentially deleting up to seven months of Wayne Tracker emails.¹⁶⁹

Notwithstanding Feinstein's own role in ensuring electronic compliance with document production and audit

requirements, she stated that she was not aware of the Wayne Tracker emails until 2017.¹⁷⁰ She confirmed, however, that several Exxon executives, including at least one who was directly involved in producing subpoenaed documents, were aware of the account.¹⁷¹ Nonetheless, Wayne Tracker emails were not initially provided to the Attorney General's office as part of the investigation.

Even more striking is the fact that Michele Hirshman, outside counsel for ExxonMobil, testified that she had knowledge of the secret email account in early 2016.¹⁷² However, she chose not to disclose the existence of the account as she believed it would "be an interesting test of whether the Attorney General's office is reading the documents[.]"¹⁷³

The foregoing examples provide compelling evidence that ExxonMobil operated systematically, across years, and with the complicity of multiple top-level executives, to engage in schemes to, at best, withhold critical information, and, at worst, defraud investors and the public at large. This evidence of deliberate efforts to conceal critical corporate information raises further questions about what further investigations of Exxon will uncover—and what future investigations

into other major carbon producers may reveal.

The Petroleum Industry Was Researching Technologies that Could Have Been Used to Mitigate or Avoid Climate Change

Major oil companies have been on notice for decades of the potential risks their core products pose to the atmosphere, the climate, and the planet. This raises a corollary question: What, if any, opportunities were available to the oil industry to avoid or reduce these risks?

The most important opportunity for doing so would have been to immediately reduce, or at least limit, the production of oil, gas, and other fossil fuels until emissions could be controlled. In fact, the opposite occurred. More than half of all global greenhouse gas emissions have been emitted since 1988, well after oil and gas producers were on clear notice of climate risks.

Another opportunity for action would have been to immediately and effectively warn the public regarding the potential climate risks associated with the production and use of fossil fuels. As the foregoing evidence demonstrates, however, the industry repeatedly failed to warn consumers, investors, and the broader public about those risks; and, indeed, engaged in ongoing and systematic efforts to convince the public that climate science was uncertain, climate risks were nonexistent or exaggerated, or that vital measures to reduce carbon emissions and promote cleaner energies were unwarranted or not feasible.

Finally, oil and gas companies could have moved quickly to design, develop, and deploy new technologies to dramatically curtail greenhouse gas emissions or to replace greenhouse gas emitting fossil fuels with cleaner energy alternatives. Here, again, the available evidence suggests that oil and gas companies had the resources and opportunity to act, yet repeatedly failed to do so.

EXHIBIT 3

Excerpt from NY Attorney General's Memo, 2017

The testimony of Ms. Feinstein and Ms. Hirshman made clear that Exxon failed to take the required steps to locate, preserve, and recover critical electronically-stored information from key custodians, including former Chairman and CEO Rex Tillerson. ¶¶ 55-65, 72-86, 99-106.

For example, during Ms. Hirshman's testimony, she testified that she knew in "early 2016" about the second email address for Rex Tillerson – the Wayne Tracker email address – and that she did not disclose that email address to OAG, stating that it would "be an interesting test of whether the Attorney General's office is reading the documents." ¶ 76, Ex. 16 (Hirshman Tr.) at 134

(emphasis added). Ms. Hirshman further testified that neither she nor her firm made any attempt to look further into the preservation, collection or production of documents of the Wayne Tracker email address at that time. The consequence of this failure was months of automatic destruction of relevant correspondence involving Mr. Tillerson. *Id.* at 141-42.

BOX 2

A Note on Carbon Removal Technology

© Alex Gindin/Unsplash



The removal and storage of carbon dioxide as an emissions reduction strategy remains unproven, uneconomic, and highly risky.¹⁸⁰ Even assuming such technologies could be deployed at the massive scale envisioned and promoted by industry today, and that the immense impacts to land, water, communities, and human rights attendant to that deployment could be addressed, the prospects for keeping massive quantities of CO₂ effectively buried for thousands of years are extremely uncertain.¹⁸¹ Moreover, the oil industry's long promotion of carbon capture as a tool for extracting additional oil and gas from the ground through "enhanced oil recovery" makes the potential benefits for the climate illusory at best. Nonetheless, had technologies for removing CO₂ from waste streams been seriously deployed more than four decades ago—and their attendant costs properly factored into the costs of burning fossil fuels—both the scale of the climate crisis and the economic externalities that effectively subsidize oil and gas combustion might have been reduced.

Patent filings and related documents demonstrate that, from as early as the 1950s, the petroleum industry was researching and patenting technology for removing CO₂ from waste streams, low emission vehicles, fuel cells, and solar panels—all technologies which might have been deployed to reduce emissions and mitigate the impacts of climate change.

In 1954, the Standard Oil Development Company patented a process for the "Production of Pure Carbon Dioxide" from the combustion of fossil fuels.¹⁷⁴ A patent for removing carbon dioxide, among other gases, was assigned to Phillips Petroleum Company in 1966.¹⁷⁵ Another patent for the removal of acidic gases—including carbon dioxide—from gaseous streams in 1973 is assigned to Shell Oil Company.¹⁷⁶

Carbon dioxide has important commercial uses, and it is not clear that these companies were patenting processes for removing carbon dioxide and other gases for the purpose of reducing greenhouse gas emissions. Esso, for example, holds patents from 1965¹⁷⁷ and 1970¹⁷⁸ for processes of injecting carbon dioxide into

wells to increase the recovery of petroleum—a process long known as enhanced oil recovery, and, in recent years, it has been misleadingly touted as a form of "carbon capture and storage." However, what is clear is that regardless of the *purpose* of these patents, the industry was aware of and actively researching techniques to remove carbon dioxide from gaseous streams. In fact, and as noted earlier in this report, a 1980 document from Imperial Oil (Exxon's Canadian subsidiary) indicates that the company was eminently aware of both the ability of carbon dioxide reduction technologies and the relationship that technology had to climate change. "There is no doubt that increases in fossil fuel usage and decreases in forest cover are aggravating the potential problem of increased CO₂ in the atmosphere. Technology exists to remove CO₂ from stack gases but removal of only 50% of the CO₂ would double the cost of power generation."¹⁷⁹

Oil companies were also investing heavily in fuel cell technology. Between 1963 and 1970, at least five patents for fuel cells were assigned to Esso Research and Engineering Company.¹⁸² Over the same period, additional fuel cell patents were assigned to Shell Oil and the Standard

Oil Company of Ohio.¹⁸³ Indeed, oil company patents accounted for a significant portion of the overall fuel cell research discussed in the review. Again, regardless of whether the interest in this research was to produce low-emissions vehicles for their emission profile, because they appeared to be a profitable business venture, or for any other reason, these patents demonstrate that at least three oil companies were not just aware of, but developing, fuel-cell technologies with potential uses in electric or hybrid vehicles. This research is unsurprising in light of rising interest in clean and electric vehicle technologies during the early 1960s. And it was offered as a rationale in 1967, when Robert Dunlop, president of Sun Oil and chairman of API, testified before Congress that federal research subsidies for electric vehicles and other alternatives to internal combustion engines were completely unnecessary because his industry was already doing that research.¹⁸⁴

In 1974, responding to the oil crisis of the preceding year, the US Congress enacted the Solar Energy Research Development and Demonstration Act, generating billions of dollars in federal research subsidies for solar technologies.

Over the ensuing years, major oil companies captured a significant proportion of those subsidies—either through developing their own patents¹⁸⁵ or by buying up smaller solar energy companies.¹⁸⁶ By the late 1980s, the majority of solar energy production in the United States was owned or controlled by the oil industry.¹⁸⁷ Oil companies continued to own large portions of the solar energy industry for the ensuing

“There is no doubt that increases in fossil fuel usage and decreases in forest cover are aggravating the potential problem of increased CO₂ in the atmosphere. Technology exists to remove CO₂ from stack gases but removal of only 50% of the CO₂ would double the cost of power generation.”

— IMPERIAL OIL, 1980

decade and into the 2000s.¹⁸⁸

It is extremely difficult to assess how the path of development, electrification, and carbonization might have changed had the petroleum industry properly disclosed the risks of climate change to consumers, regulators, and the broader public. The degree to which we would have demanded low-carbon energy and transportation had we been properly warned remains equally uncertain. It is not clear how much damage would have been avoided if the petroleum industry had deployed the technologies it knew could reduce CO₂ emissions, or had developed or released the numerous patents it held for clean energy technologies. What is certain, however, is that we have strong and growing evidence that major oil companies had both the ability and the opportunity to take such steps beginning many decades ago.

Summary of Industry Knowledge of and Action on Climate Change

The following basic conclusions can be drawn from the foregoing synthesis. The

theory that accumulating carbon dioxide could cause global warming and large-scale climatic changes dates back to the nineteenth century. The fact that fossil fuel combustion releases tremendous amounts of carbon dioxide waste to the atmosphere has been undisputed for more than a century. In 1938, at least one scientist claimed to have measured a noticeable impact both on atmospheric carbon dioxide and global temperatures.

From no later than the 1940s, and continuing thereafter, the oil industry was actively engaged in pioneering research in an array of areas relevant to climate change and climate impacts. This included, *inter alia*, research into long-term changes in the earth's temperature; the relationship between global temperatures and sea level rise; changes in the concentration of CO₂ in the atmosphere; the nature, causes, and history of hurricanes; and techniques, technologies, and consequences of intentional weather modification.

In 1957, Roger Revelle and Hans Suess published research demonstrating that the world's oceans would not rapidly absorb this CO₂ and suggested carbon dioxide levels in the atmosphere were likely to increase significantly. Scientists working at Humble Oil (now ExxonMobil) were aware of this research at the time of its publication and published their own research in early 1958, in which they recognized the increase in atmospheric CO₂, acknowledged the connection between fossil fuel combustion and that increase, acknowledged the link between atmospheric CO₂ and potential temperature increases, and acknowledged Revelle's criticisms of their own conclusions on ocean absorption of CO₂. *By no later than 1957, therefore, at least one major oil company was clearly on notice that the most important waste product from oil and other fossil fuels might be accumulating in the earth's atmosphere with the potential to affect the climate on a planetary scale.*

By 1958, the oil industry as a whole, through the American Petroleum

Institute's Smoke and Fumes Committee, was funding collective research into the accumulation of fossil carbon in the atmosphere. *By no later than 1958, therefore, the oil industry collectively was on notice that the most important waste product from oil and other fossil fuels might be accumulating in the earth's atmosphere, and it was funding research into this question as part of an industry-wide air pollution program.*

Industry records, oral histories from persons involved, and analyses of its activities by independent researchers strongly indicate that the core mission of the Smoke and Fumes Committee was to combine industry-funded research and public relations advocacy in order to increase public skepticism about air pollution science, with the express purpose of influencing legislation and regulation on pollution issues. Credible firsthand accounts suggest research was undertaken to prove a pre-determined result—in the case of Harold Johnstone, to discredit Arie Haagen-Smit's theory of smog—and that unfavorable results were neither welcomed nor shared.

In 1968, a Stanford Research Institute report commissioned by API, summarized the causes, nature, and consequences of global warming and climate change. The report warned the oil industry explicitly and in strong terms that the science underlying climate change was sound, that fossil fuel combustion provided the best explanation for climate change, that the impacts of climate change could be potentially significant on a global scale, and that the industry's highest research priority should be identifying means and technologies for reducing emissions. The core of its analysis was further substantiated in a supplemental report prepared by the same authors at the request of API. The oil industry's receipt of this report was acknowledged in other discussions of API-funded research, and the 1968 report was explicitly and extensively cited in communications between industry executives and the Department of the Interior (DOI), although the sections on

carbon dioxide were not shared with DOI. *By no later than 1968, therefore, the oil industry was receiving warnings from its own scientists that evidence of climate change was credible and that, despite uncertainties about the scale and timing of impacts, the potential risks of climate change were real and serious.*

Between 1977 and 1982, scientists at Exxon and other oil companies repeatedly acknowledged the scientific consensus that climate change was happening, was caused primarily by the burning of fossil fuels, and had the potential to be globally catastrophic. Exxon internally transmitted its understanding of this in a 43-page climate change primer. An Exxon subsidiary was conducting scientific research in the Arctic no later than 1986, which examined the effects climate change would have on intended operations. It has been documented that in 1989, Shell Oil deliberately changed the design of their offshore oil drilling platform to account for sea level rise, and that in 1991, the leader of the Imperial Oil expedition acknowledged that internal planning would need to account for climatic changes in the Arctic. In 1995, fossil fuel interests were fully aware that the fundamental realities of climate

science were overwhelming supported by the weight of credible science and that a response was urgently needed. *From the 1970s forward, therefore, scientists within the oil industry not only acknowledged the scientific consensus that climate change was occurring, but took potential climate impacts into account in the companies' own long-term plans.*

In 1998, the American Petroleum Institute developed a public relations strategy with the aim of sowing doubt about the certainty of climate science in the minds of the public, legislators, and regulators. ExxonMobil, API, and others funded research into debunked theories to explain rising atmospheric temperatures without disclosing the source of funding. Analysis demonstrates that, while Exxon's internal understanding of climate change was advanced, its public communications between 1977 and 2014 expressed significant doubt and uncertainty. In 2014, the Western States Petroleum Association fought against state-level regulation in California by misrepresenting public will through the use of "Astroturf" front groups. Many oil and gas companies continue to donate money to the American Legislative

Exchange Council (ALEC), which promotes climate-denial to this day. Finally, ExxonMobil and its executives still continue their pattern of downplaying both the severity of climate change and the role of human emissions in it. *From the 1990s forward, therefore, the oil industry acknowledged climate science internally and took measures to incorporate climate risks into their own project planning, while maintaining active campaigns to promote skepticism of climate change science and climate risks among policymakers, journalists, and the public.*

From the 1950s onward, oil companies developed and patented numerous technologies that might have been deployed to reduce greenhouse gas emissions, including fuel cells and advanced batteries, low-emission vehicle technologies, and technologies for removing carbon dioxide from industrial

From the 1990s forward, therefore, the oil industry acknowledged climate science internally and took measures to incorporate climate risks into their own project planning, while maintaining active campaigns to promote skepticism of climate change science and climate risks among policymakers, journalists, and the public.

waste streams. In 1980, an ExxonMobil subsidiary acknowledged the potential value of the company's patents in addressing climate risks, but noted that doing so would raise the costs of the company's patents unacceptably. By the end of the 1980s, major oil companies owned or controlled the majority of solar panel production in the United States. *From the 1980s forward, therefore, one or more oil companies had the technical capacity and the opportunity to reduce climate risks associated with greenhouse gas emissions, but chose not to do so for commercial reasons.*



BOX 3

Prior Petroleum Industry Pollution Events Reveal a Pattern of Denial and Obfuscation



© realworkhard/Pixabay

Oil industry executives and their allies have repeatedly dismissed allegations that the industry misled the public on climate change and climate science as baseless conspiracy theories. As the foregoing discussion demonstrates, however, the available documentary evidence tells a different story, suggesting a clear pattern of investigation, concealment, and obfuscation on the part of major companies and industry groups. Oil industry engagement in similar patterns of conduct—discovery, investigation, concealment, obfuscation—often spanning decades, has been extensively documented across an array of public health and environmental issues, including lead,¹⁸⁹ smog,¹⁹⁰ vinyl chloride,¹⁹¹ and benzene,¹⁹² among others.

The documented history of industry engagement on these issues, including efforts to suppress or undermine relevant science, the targeting of scientists for personal and professional attack, and the use of advertising, editorials, and other tools to encourage consumer skepticism about the need for action, is relevant to assessing the industry's potential conduct on climate change in light of the available evidence.

The complex and long-hidden history of the oil industry's engagement with the tobacco industry provides additional insight into these recurring patterns of conduct. This history and relevant documentation, drawn from the 16 million industry documents of The Tobacco Archive, are discussed extensively elsewhere.¹⁹³ The example of the industries' intersection in the work of Theodor Sterling is instructive.

From the 1960s into the 1980s, Dr. Theodor Sterling was among the scientists most heavily relied upon and heavily valued by the tobacco industry.¹⁹⁴ Sterling was not a medical doctor but a mathematician and computer scientist, whose work focused on issues of study design and epidemiological proof. More specifically, Sterling argued that it was nearly impossible to prove through epidemiological data that a particular pollutant was the cause of a specific disease. Sterling's value to the industry lay not in his expertise in identifying the causes of cancer, therefore, but in his arguments that these causes were nearly impossible to prove in most cases—that no matter the amount of data or modeling, there was always room for uncertainty and doubt. Sterling pioneered these strategies in the early 1960s, while working on questions

of lead exposure, including on behalf of Ethyl Corporation, a joint venture co-owned by General Motors and Standard Oil of New Jersey (now ExxonMobil).¹⁹⁵

In 1968, Sterling prepared a report on the "Feasibility" and appropriate mechanisms for reviewing public health research related to smoking and resolving the competing views of public health and tobacco industry experts on these issues.¹⁹⁶ He recommended to that the industry advocate for "a permanent commission...for the purpose of establishing a consensus on the results of various studies and what they mean."¹⁹⁷ Industry records indicate that Sterling's recommendation arose in large part due to the contributions of Robert Eckardt, a member of the study advisory committee and Medical Director of Esso Research (now ExxonMobil).¹⁹⁸ Eckardt was a member of the petroleum industry's Air Pollution Research Advisory Committee (APRAC), upon which the recommended commission was based.¹⁹⁹ Later, a 1975 cigarette industry document would recount how the petroleum industry used the APRAC, an ostensibly neutral body with government participation, to "launder" research that made its products seem safe when they were not.²⁰⁰

While the behavior of the petroleum industry in relation to lead, smog, vinyl chloride, and benzene does not directly implicate its liability for climate change, it does reveal a pattern. We know that Theodor Sterling, whose academic work supported the cigarette industry through three decades, worked with oil industry interests on questions of lead pollution, doing research that would be used to defend lead in gasoline. We also know that when Sterling made recommendations after a feasibility study for the cigarette companies, he based those recommendations on a model developed by petroleum companies—a model the cigarette companies would later acknowledge as effective in legitimizing shoddy, industry-favoring research.

We also know, directly, that the Smoke and Fumes Committee of the American Petroleum Institute was designed deliberately to affect regulation, and that we have one personal account of the methods by which the industry would use seemingly independent research institutes to produce favorable science. It should not be surprising that the cigarette industry also contracted extensively with Stanford Research Institute.²⁰¹

Key Findings

On the basis of the foregoing evidence, several essential conclusions may be drawn with regard to the notice, awareness, opportunity to act, and documented conduct of leading investor-owned oil companies with regard to climate science and climate risks.

- Theories regarding the potential link between fossil fuel combustion and atmospheric temperature increase were widely reported in scientific literature and academic texts relevant to the oil industry from the early decades of the twentieth century.
- The oil industry had incentives, opportunity, and relevant expertise to investigate and understand climate science.
- Documentary evidence demonstrates the oil industry was on notice of potential climate risks by 1957-1958.
- Humble Oil, at the time a wholly-owned subsidiary of Esso (now ExxonMobil), published research acknowledging the link between fossil fuels and atmospheric CO₂ in 1957.
- Industry records document that industry research into air pollution issues was highly coordinated and shared widely within the industry, and included research into fossil carbon in the atmosphere by no later than 1958.
- Industry records and other sources indicate that this coordinated industry research program was used to mobilize public opposition to the regulation of air pollutants by sowing doubt regarding air pollution science.
- The oil industry was expressly warned of the potential severity of climate risks by its own consulting scientists in 1968 and repeatedly thereafter.
- Numerous industry documents demonstrate these risks were communicated by industry scientists to executives at the highest levels of the industry over the ensuing decades.
- The oil industry held early patents on numerous technologies that might have reduced climate change risk.
- Even while blocking public action to address climate change, oil companies took steps to protect their own assets from climate risks. This divergence between industry communications to the public and industry action to safeguard their own investments began as early as the 1970s and is well established by the 1980s.
- Notwithstanding their own best information, leading oil companies and industry associations actively participated in or funded climate misinformation efforts for decades through media intended to reach wide audiences of consumers, investors, and the general public.



Beyond Exxon and Beyond the US: The Expanding Investigations into Climate Denial

To date, the primary focus in investigations of climate science and climate denial, including within the oil and gas industries, has centered on the United States. This focus is understandable in light of the extensive data that has already come to light, the documented effectiveness of climate denial efforts in sowing uncertainty, skepticism, and denial in the United States, and the demonstrable impacts of climate obstruction and inaction on US climate policy at home and abroad.

It is important to recognize the relevant inquiry doesn't end with those companies. As earlier noted, the coal industry has a well-documented history of climate denial, and a handful of the largest coal producers are also listed among the major carbon producers.

Nor should that inquiry stop at US borders. The oil and gas companies involved in denial efforts operated worldwide, and knowledge was shared widely across the industry and within individual companies. It is highly likely that major carbon producers in Europe and elsewhere had notice equivalent to that of their US counterparts.

To date, the role of European oil and gas companies in climate denial has received less scrutiny than their US counterparts. Nonetheless, a modest but compelling body of evidence demonstrates industry-funded denial was a transboundary phenomenon. Evidence suggests that European companies such as British Petroleum (United Kingdom) and Royal Dutch Shell (Netherlands and United Kingdom) participated in multiple aspects of US climate denial efforts dating back to the original Smoke and Fumes Committee, either directly through their US subsidiaries or through companies they later acquired. Both BP and Shell, for example, were active in the American Petroleum Institute, and appear numerous times throughout the

preceding pages at crucial junctures, including in distribution lists for API research.

Similar efforts have been documented within Europe itself—funded both by European companies and their US counterparts. Corporate Europe Observatory (CEO) shed light on such industry denial efforts in Europe in a report released in 2010. CEO documented, for example, how BP directly funded the Institute of Economic Affairs (IEA), a think tank that promotes radical free market approaches to issues.²⁰² IEA has produced a number of documents featuring some of the favorite arguments of prominent climate change deniers, including that “government

To date, the role of European oil and gas companies in climate denial has received less scrutiny than their U.S. counterparts. Nonetheless, a modest but compelling body of evidence demonstrates industry-funded denial was an international phenomenon.

claims about the seriousness of global warming are suspect” and that global warming will actually be beneficial to the planet.²⁰³ In the same report, CEO also profiled seven other prominent climate denial groups in Europe—the International Policy Network, CFACT Europe, the Global Warming Policy Foundation, Instituto Juan de Mariana, CEPOS, Institut Economique Molinari, and Hayek Institute—noting that without mandatory financial transparency, it was unclear who was funding these organizations.²⁰⁴

Additional information indicates European denial groups were also being funded by American sources. For example, ExxonMobil provided the International Policy Network with nearly \$400,000 from 2003 through 2006.²⁰⁵ Moreover, organizations known to be funded by ExxonMobil and the Charles Koch Foundation in the United States

have deep and persistent ties to organizations in Europe.²⁰⁶ For example, CFACT Europe, based in Germany, is the European branch of the US Committee for a Constructive Tomorrow (US CFACT).²⁰⁷ While CFACT Europe's finances are secret, US CFACT had received over \$500,000 from ExxonMobil.²⁰⁸ The American Friends of the Institute of Economic Affairs, the American branch of IEA, received \$50,000 from ExxonMobil.²⁰⁹

Similarly, individuals with ties to American denial groups often hold positions or have significant relationships with European denial groups. In 2010, Holger Thuss, founder and then Executive Director of CFACT Europe, was also listed on the US CFACT website as a staff member.²¹⁰ Gabriel Calzada, founder of Instituto Juan de Mariana, authored a 2009 report declaring that renewable energy policies would destroy 2.2 jobs for every job they produced.²¹¹ That report was commissioned by the US-based Institute for Energy Research, which has received over \$300,000 from ExxonMobil, as well as funding from Koch-affiliated sources.²¹²

Much remains to be discovered about these operations, the companies involved, and their intersection with broader industry efforts around the world. One thing, however, is already clear: For major carbon producers around the world and the communities harmed by their decades of action and inaction on climate change, the investigations into Exxon are the beginning of this story, but they are by no means the end.

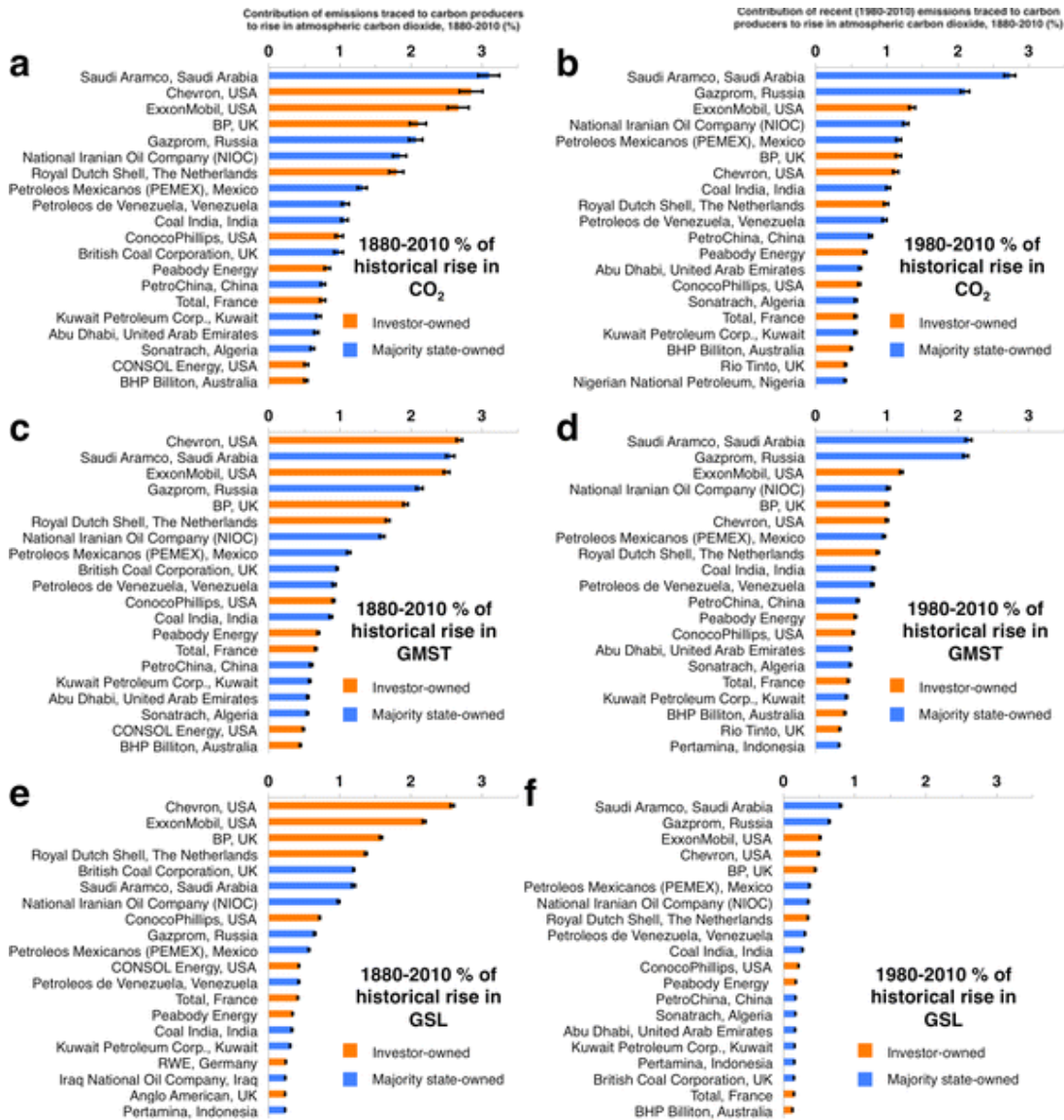
APPENDIX I

Investor-Owned Carbon Majors**Ranked by cumulative emissions contribution***

1. Chevron
2. ExxonMobil
3. BP
4. Royal Dutch Shell
5. ConocoPhillips
6. Peabody
7. Total
8. Consol Energy
9. BHP Billiton
10. Anglo American
11. Arch Coal
12. ENI
13. RWE
14. Rio Tinto
15. Anadarko
16. Occidental
17. Alpha
18. Lukoil
19. Rosneft
20. Sasol
21. Repsol
22. Marathon
23. Xstrata
24. Yukos
25. Hess
26. Devon Energy
27. Encana
28. BG Group
29. Cyprus
30. Suncor
31. Westmoreland Mining
32. Kiewit Mining
33. Apache
34. North American Coal Corporation
35. Lafarge
36. Canadian NR
37. Holcim
38. Luminant
39. RAG
40. Talisman
41. Murray Coal
42. UK Coal
43. Husky
44. HeidelbergCement
45. Cemex
46. Italcementi
47. Murphy Oil
48. OMV
49. Taiheiyō
50. Massey
51. Nexen

*Carbon Majors Update to 2013: Carbon Major Entities Cumulative Emissions to 2013 Ranked, CLIMATE ACCOUNTABILITY INSTITUTE (Nov. 25, 2014), <http://www.climateaccountability.org/pdf/SumRanking%20Dec14%208p.pdf>.

The following six charts are drawn from the 2017 study by Ekwurzel, et al., which details the relative contribution of the Carbon Majors to atmospheric CO₂ accumulation, the rise in global mean surface temperatures, and the rise of global sea levels. Each chart identifies the twenty Carbon Majors with the greatest contribution in each category, with the charts on the left extending back as far as 1880, and the charts on the right only accounting for the thirty-year period between 1980 and 2010.**



**B. Ekwurzel, et al., *The Rise in Global Atmospheric CO₂, Surface Temperature, and Sea Level From Emissions Traced to Major Carbon Producers*, 144(4) CLIMATIC CHANGE 579 (2017), available at <https://link.springer.com/article/10.1007/s10584-017-1978-0>.

APPENDIX II

A Note on Sources

This synthesis draws or builds on documentary evidence compiled from a number of sources, including: early and pioneering research by Greenpeace's Exxon Secrets project; pathbreaking research by Dr. Naomi Oreskes of Harvard University and Erik Conway of Jet Propulsion Laboratory, California Institute of Technology; multi-part investigations published in 2015 and 2016 by *InsideClimate News*, *Los Angeles Times*, and the Columbia School of Journalism; documents unearthed by non-profit organizations, including *DeSmog Blog*, the Climate Investigations Center, Climate Files, and the Union of Concerned Scientists; and CIEL's own Smoke and Fumes project, a multi-year investigation into the early history of climate science with particular attention to the oil and gas industries' awareness of, engagement in, and communications about that science.

To facilitate direct access to relevant evidence, hyperlinks to cited documents

have been provided wherever feasible. At the time of publication (Nov. 2017) all hyperlinks were functional and accurate, although some linked documents are subject to paywalls or other limitations.

An earlier version of this synthesis was shared with the Philippines Commission on Human Rights in April 2016 in conjunction with an amicus curiae brief submitted to the Commission in its examination of how oil companies' operations have affected human rights in the Philippines. The present synthesis draws on the more extensive material released during the ensuing months.

The volume of documentary evidence arising from these various research initiatives is now staggering. CIEL's database alone includes more than 200 documents, spanning more than seven decades, not including books and archival documents not available online. The *InsideClimate News* investigations include at least twelve separate articles supported

by scores of primary documents. Research by the Union of Concerned Scientists has unearthed more than 340 pages of documents in seven dossiers addressing various aspects of the climate. Accordingly, the present synthesis can only highlight key findings to date. It is indicative of the available evidence, but by no means exhaustive.

More fundamentally, it should be noted that the great majority of relevant documents, including more than two million pages of documents produced by Exxon pursuant to an investigation in New York State, have yet to be publicly disclosed. Untold numbers of additional documents remain undiscovered and as yet undisclosed by the corporate actors involved, including by the Carbon Majors themselves.

APPENDIX III

A Note on Industries and Companies Addressed in this Synthesis

The documents referenced in this synthesis report offer insights into specific activities undertaken by leading oil companies and petroleum industry groups, including all five of the largest investor-owned oil companies as measured by aggregate emissions.

This report focuses almost exclusively on the oil and gas industries and particularly on companies headquartered in or with substantial operations in the United States. This emphasis arises from the greater availability of public information regarding industry research activities and engagement on denial efforts in the United States; and the historically smaller number of very large actors in the oil and gas industry as compared to coal or cement industries. A detailed discussion of these factors follows.

(1) Climate misinformation campaigns have been actively carried out for many years in Australia, the United Kingdom, and across Europe. Based on the best information currently available, however, climate denial campaigns within the United States have been among the largest, longest-lived, and best funded such efforts on a global basis. As a result, they have drawn significantly more media and investigative attention than climate misinformation efforts, with the result that a much greater number of primary materials, including eyewitness accounts, are available for analysis. Additional investigation into the knowledge and conduct of major fossil fuel producers and related industry groups in other countries and regions is warranted.

(2) For the first six decades of twentieth century, the global oil and gas industries were vertically integrated and heavily concentrated among a very small number of companies that exercised substantial control over all phases of research, exploration, production, transportation, refining, and marketing of petroleum and petroleum products on a global basis. These companies—known colloquially as the Seven Sisters, and comprised of five US-based companies, plus BP and Royal Dutch Shell—routinely entered into partnerships and joint ventures in countries around the world. As a result, the largest oil and gas companies evinced a greater than usual degree of coordination and collaboration than was common in many other industries. Beginning in the 1960s, waves of nationalization by oil-rich countries reduced industry concentration and control to a significant degree. Since the 1970s, states and state-owned enterprises (SOEs) have accounted for a significant proportion of oil reserves and production (thus the representation of SOEs among the Carbon Major respondents). Nonetheless, the largest oil companies remained key service providers in the oil exploration and production space; and waves of mergers and acquisitions again reduced the number of key investor-owned companies in the industry from the 1980s onward. Throughout recent decades, the leading investor-owned oil companies have remained key players in the exploration and opening of new oil and gas frontiers, the provision of advanced production technologies and techniques to national oil companies and state-owned enterprises, and the

marketing of petroleum products in the United States, Europe, and worldwide.

(3) The oil industry began operating internationally very early in its history. Consequently, almost all of the largest US-based firms operated internationally. Correspondingly, the largest investor-owned oil companies from Europe, including notably BP and Royal Dutch Shell, maintained significant commercial ties with and operations within the United States. As a result, BP and Royal Dutch Shell, or their corporate predecessors, do appear regularly in documents and research originating in the US. Further, documents addressed in the report periodically address the international role or operations of the US-based Carbon Majors, such as ExxonMobil and Chevron.

(4) Notwithstanding the smaller size of individual coal companies relative to the largest oil and gas companies, particularly in the United States, coal companies exercised significant political influence in the United States throughout the twentieth century and into the twenty-first. Documents disclosed during recent bankruptcy procedures indicate that at least three US-based coal companies among the respondents—Peabody Coal, Arch Coal, and Alpha Natural Resources—continued to fund climate misinformation efforts well into the present decade. Reputable news reports on these disclosures are cited in the synthesis.

Given the comparative paucity of widely available public documents addressing the

activities of major carbon producers based outside the US, the absence of specific reference to activities of non-US companies should not be construed as evidence of absence. As investigations continue or commence in jurisdictions around the world, it is likely that additional evidence will come to light and that some of this evidence may offer insights into the specific knowledge of other leading carbon producers with respect to climate change, and with respect to their actions in light of that knowledge. At the same time, and until such new information becomes available, no activities in this report should be imputed to companies for which

documentation does not exist, with one exception:

In the view of CIEL, and in the absence of compelling evidence to the contrary, it is reasonable to infer that, at all relevant times, every leading carbon producer, as an assumed expert in the products it produced and/or brought to market, was aware or should have been aware of the state of climate science and the existence of potentially significant climate risks associated with its products to a degree generally commensurate with other companies in its industry and/or national context.

Endnotes

- 1 See Gero Reuter, *Peruvian Farmer Sues German Energy Firm RWE*, DEUTSCHE WELLE (Nov. 24, 2016), <http://www.dw.com/en/peruvian-farmer-sues-german-energy-firm-rwe/a-36506880>.
- 2 See John Vidal, *World's Largest Carbon Producers Face Landmark Human Rights Case*, THE GUARDIAN (July 27, 2016, 11:11 AM), <https://www.theguardian.com/environment/2016/jul/27/worlds-largest-carbon-producers-face-landmark-human-rights-case>.
- 3 See Jon Chesto, *Conservation Law Foundation Sues Exxon Mobil*, BOSTON GLOBE (Sept. 29, 2016), <https://www.bostonglobe.com/business/2016/09/29/conservation-law-foundation-follows-through-its-threat-sue-exxon-mobil/x6VW5yPu0Sbdi89TVaSrmlJ/story.html>.
- 4 See Gary McWilliams, *California Cities Sue Big Oil Firms Over Climate Change*, REUTERS (Sept. 20, 2017, 9:34 PM), <https://www.reuters.com/article/us-climatechange-accord-temperature/this-year-to-be-among-three-hottest-on-record-extraordinary-weather-u-n-idUSKBN1D619E>.
- 5 Note that Carroll Muffett, President of CIEL and a co-author of this paper, is also a member of the Board of Trustees of CAI.
- 6 Richard Heede, *Tracing Anthropogenic Carbon Dioxide and Methane Emissions to Fossil Fuel and Cement Producers, 1854 – 2010*, 122(1-2) CLIMATIC CHANGE 229 (2014), available at <https://link.springer.com/article/10.1007/s10584-013-0986-y>. Note that Heede deducts for net non-energy use of petroleum, gas, and coal for lubricants, petrochemicals, road oil, fertilizer, carbon fibers, pigments, etc.
- 7 See *id.*
- 8 See *id.*
- 9 See *id.*
- 10 See *Carbon Majors Update*, CLIMATE ACCOUNTABILITY INSTITUTE, http://www.climateaccountability.org/carbon_majors_update.html (last visited Nov. 6, 2017).
- 11 See CDP, THE CARBON MAJORS DATABASE (2017), available at <https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/002/327/original/Carbon-Majors-Report-2017.pdf?1501833772>.
- 12 See B. Ekwurzel et al., *The Rise in Global Atmospheric CO₂, Surface Temperature, and Sea Level From Emissions Traced to Major Carbon Producers*, 144(4) CLIMATIC CHANGE 579 (2017), available at <https://link.springer.com/article/10.1007/s10584-017-1978-0>.
- 13 See *id.*
- 14 Henry Shue, *Responsible for What? Carbon Producer CO₂ Contributions and the Energy Transition*, 144(4) CLIMATIC CHANGE 591, 594 (2017), available at <https://link.springer.com/content/pdf/10.1007%2Fs10584-017-2042-9.pdf>.
- 15 See OLIVER WENDELL HOLMES, JR., THE COMMON LAW (1963).
- 16 Stephen R. Perry, *Responsibility for outcomes, Risk, and the Law of Torts*, in PHILOSOPHY AND THE LAW OF TORTS 72, 83 (Gerald J. Postema, ed., 2001).
- 17 See *id.* at 91.
- 18 John C.P. Goldberg & Benjamin C. Zipursky, *Tort Law and Responsibility*, in PHILOSOPHICAL FOUNDATIONS OF THE LAW OF TORTS (John Oberdiek, ed., 2014).
- 19 Perry, *supra* note 16, at 105.
- 20 Goldberg & Zipursky, *supra* note 18, at 22.
- 21 INTERNATIONAL COMMISSION OF JURISTS, CORPORATE COMPLICITY & LEGAL ACCOUNTABILITY, VOLUME 3: CIVIL REMEDIES (2008), available at <http://www.icj.org/wp-content/uploads/2009/07/Corporate-complicity-legal-accountability-vol3-publication-2009-eng.pdf>.
- 22 *Id.*
- 23 See *id.* at 7.
- 24 See U.N. Special Rep. on Business & Human Rights, *Guiding Principles on Business and Human Rights: Implementing the United Nations "Protect, Respect and Remedy" Framework*, U.N. Doc. A/HRC/17/31 (Mar. 21, 2011), available at <https://business-humanrights.org/sites/default/files/media/documents/ruggie/ruggie-guiding-principles-21-mar-2011.pdf> [hereinafter Ruggie Principles].
- 25 Human Rights Council Res. 17/4, Human Rights and Transnational Corporations and Other Business Enterprises, 17th Sess., May 30-June 17, 2011, A/HRC/RES/17/4 (July 6, 2011), available at <https://business-humanrights.org/sites/default/files/media/documents/un-human-rights-council-resolution-re-human-rights-transnational-corps-eng-6-jul-2011.pdf>.
- 26 See Ruggie Principles, *supra* note 24.
- 27 See *id.* at 14-17.
- 28 See *id.* at 16-17.
- 29 See *id.* at 17.
- 30 See Peter C. Frumhoff, Richard Heede, Naomi Oreskes, *The Climate Responsibilities of Industrial Carbon Producers*, 132(2) CLIMATIC CHANGE 157 (July 23, 2015), available at <https://link.springer.com/article/10.1007/s10584-015-1472-5>.
- 31 See *id.*
- 32 Shue, *supra* note 14, at 594.
- 33 SPENCER WEART, THE DISCOVERY OF GLOBAL WARMING 3 (2008).
- 34 See, e.g., THOMAS C. CHAMBERLIN & ROLLIN S. SALISBURY, GEOLOGY, vol. 3, 444-45 (1907) (discussing the work of Arrhenius, Angstrom and others); JW Gregory, *Climatic Variations: Their Extent and Causes*, International Geological Congress 1906, reprinted in *Annual Report of the Smithsonian Institution* 33944, at 347-48 (1908) (discussing with approval the work of Arrhenius and Chamberlin on the role of atmospheric CO₂ in climate change); FRANK WIGGLESWORTH CLARK, THE DATA OF GEOCHEMISTRY (4th ed.) 48-49. (1920) ("At 3 parts in 10,000 the carbon dioxide in the atmosphere amounts to about 2,200,000,000,000 tons, equivalent to 600,000,000,000 tons of carbon. ... The annual consumption of coal, estimated by A. Krogh at 700,000,000 tons in 1902, adds yearly to the atmosphere about one-thousandth of its present content in carbon dioxide. In a thousand years, then, if the rate were constant and no disturbing factors interfered, the amount of CO₂ in the atmosphere would be doubled. If we take into account the combustion of fuels other than coal and the large additions to the atmosphere from the sources previously mentioned, the result becomes still more startling. Were there no counterbalancing of this increase in atmospheric carbon, animal life would soon become impossible upon our planet."); Robert E. Swain, *Atmospheric Pollution by Industrial Wastes*, 15(3) IND. ENG. CHEM. 296, 296 (1923), available at <http://pubs.acs.org/doi/abs/10.1021/ie50159a035?journalCode=iechad> ("The greatest single waste product in industry is a gas, carbon dioxide, which is usually discharged as it is produced directly into the air... If all the coal consumed annually in this country were completely burned, there would be produced approximately nine hundred thousand billion cubic meters, or one billion eight hundred million metric tons of this gas. The combustion of petroleum would add two hundred million metric tons, and of natural gas ninety million metric tons, while the burning or decay of wood, and of plant products and tissues, would add an indeterminate but enormous total to these figures. ... But it is a remarkable fact that, rapidly disbursed as it is into the great ocean about us, this gas is present in the strikingly small and uniform amount of three parts by volume of carbon dioxide to ten thousand parts of air, or three hundred parts per million parts of air.")
- 35 See, e.g., Svante Arrhenius, *On the Influence of Carbonic Acid in the Air upon the Temperature of*

- the Ground, 41 PHIL. MAG. AND J. OF SCI. 237 (1896), available at <http://patarnott.com/atms749/pdf/Arrhenius.pdf>; Charles JJ Fox, *On The Coefficients of Absorption of Nitrogen and Oxygen IX Distilled Water and Seawater, and of Atmospheric Carbonic Acid in Sea-Water* 5 TRANSACTIONS OF THE FARADAY SOC'Y 68, 68 (1909), available at <http://pubs.rsc.org/en/content/articlelanding/1909/tf/tf9090500068#divAbstract> ("The object of the present series of measurements was primarily the determination of the absorption coefficients of nitrogen, oxygen, and atmospheric carbonic acid in sea-water. These coefficients have of late years acquired some special significance, notably in connection with that group of physical problems of which Arrhenius's work on the diatherinancy of the atmospheric gases, particularly carbonic acid, and its effect upon terrestrial temperatures, is typical, and again in connection with those matters of biological interest which are concerned with the dynamic processes of pelagic life." (emphasis added)). See also Clark, *supra* note 34, at 49-50 (discussing the existence and debate over Arrhenius' theory and stating "Both carbon dioxide and aqueous vapor serve as selective absorbers for the solar rays, and, by blanketing the earth, they help to avert excessive changes of temperature. On the physical side, and as regards carbon dioxide, this question has been discussed by S. Arrhenius, who argues that if the quantity of the gas in the atmosphere were increased about threefold, the mean temperature of the Arctic regions would rise 8° or 9°").
- 36 See Guy S. Callendar, *The Artificial Production of Carbon Dioxide and its Influence on Temperature*, 64 Q. J. OF THE ROYAL METEOROLOGICAL SOC'Y 223 (1938), available at <http://onlinelibrary.wiley.com/doi/10.1002/qj.49706427503/full>.
- 37 See *id.*
- 38 See Google Scholar Search Results, https://scholar.google.com/scholar?cites=14959323493014744928&as_sdt=20005&sciodt=0,9&hl=en (search "The artificial production of carbon dioxide and its influence on temperature," then click "Cited by").
- 39 See Giles Slocum, *Has the Amount of Carbon Dioxide in the Atmosphere Changed Significantly Since the Beginning of the Twentieth Century?*, 83 MONTHLY WEATHER REV. 225 (1955), available at <http://cites.eerx.ist.psu.edu/viewdoc/download?doi=10.1.1.173.1979&rep=rep1&type=pdf>.
- 40 See Hans E. Suess, *Natural Radiocarbon and the Rate of Exchange of Carbon Dioxide Between the Atmosphere and the Sea*, in NUCLEAR PROCESSES IN GEOLOGIC SETTINGS 52, 52 (1953), available at https://books.google.com/books?hl=en&lr=&id=RmMrAAAAYAAJ&oi=fnd&pg=PA52&ots=en6W_zO0VE&sig=0PRelKURGXwO_u1VKII7AXuZUPA#v=onepage&q&f=false.
- 41 See Hans E. Suess, *Radiocarbon Concentration in Modern Wood*, 122 SCIENCE 415 (1955), available at <http://science.sciencemag.org/content/122/3166/415.2>.
- 42 See Roger Revelle & Hans E. Suess, *Carbon Dioxide Exchange Between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO₂ during the Past Decades*, 9 TELLUS 18 (1957), available at <http://www.tandfonline.com/doi/pdf/10.3402/tellusa.v9i1.9075?needAccess=true>.
- 43 See *id.*
- 44 *Id.* at 19.
- 45 See H. R. Brannon et al., *Radiocarbon Evidence on the Dilution of Atmospheric and Oceanic Carbon by Carbon from Fossil Fuels*, 38 TRANSACTIONS AM. GEOPHYSICAL UNION 643 (1957), available at <http://onlinelibrary.wiley.com/doi/10.1029/TR038i005p00643/full>.
- 46 See *id.* at 643.
- 47 See *id.* at 649.
- 48 See Charles A. Jones, *A Review of the Air Pollution Research Program of the Smoke and Fumes Committee of the American Petroleum Institute*, 8 J. OF THE AIR POLLUTION CONTROL ASS'N 268, 270 (1958), available at <http://www.tandfonline.com/doi/pdf/10.1080/0096665.1958.10467854> ("a recently placed project concerns the collection and analysis of gaseous carbon compounds in the atmosphere to determine the amount of carbon of fossil origin by analysis of carbon 14 in relation to total carbon present").
- 49 *About WSPA*, WESTERN STATES PETROLEUM ASS'N, <https://www.wspa.org/about/>.
- 50 *About API*, AMERICAN PETROLEUM INSTITUTE, http://www.api.org/about#tab_history.
- 51 See Vance N. Jenkins, *The Petroleum Industry Sponsors Air Pollution Research*, 3 AIR REPAIR 144, 146 (1954), available at <http://www.tandfonline.com/doi/pdf/10.1080/00966665.1954.10467615>.
- 52 See Jones, *supra* note 48, at 267 ("Through the efforts of the Publications Committee, the dissemination of information has a prominent place in the Smoke and Fumes Committee program.").
- 53 G. A. Lloyd, *The Petroleum Industries' Air Pollution Control Program*, 11(1) J. AIR POLLUTION CONTROL ASS'N 6, 8 (1961), available at <http://www.tandfonline.com/doi/pdf/10.1080/00022470.1961.10467967>.
- 54 *Id.*
- 55 See *id.*
- 56 See Ann C. Bauer and Harry M. Cleaver, "Minority Report," Campus Report Supplement (Stanford University Relations Office), No. 5 (April 14, 1969), available at <http://la.utexas.edu/users/hcleaver/357L/StanfordMinorityReport.html>.
- 57 *Id.*
- 58 See Jenkins, *supra* note 51, at 146-47.
- 59 See Bauer & Cleaver, *supra* note 56.
- 60 See Jenkins, *supra* note 51, at 148.
- 61 See Jones, *supra* note 48, at 269.
- 62 See Jenkins, *supra* note 51, at 145.
- 63 Harold S. Johnston, "Atmospheric Chemistry Research at Berkeley" an oral history conducted in 1999 by Sally Smith Hughes, Ph.D., Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 2005, at 63, available at http://digitalassets.lib.berkeley.edu/roho/ucb/text/johnston_harold.pdf.
- 64 See *id.*
- 65 See *id.*
- 66 See Jenkins, *supra* note 51, at 147.
- 67 See Jones, *supra* note 48, 269-70.
- 68 See ENVIRONMENTAL RESEARCH: A STATUS REPORT, AMERICAN PETROLEUM INSTITUTE 6 (1972), available at <http://files.eric.ed.gov/fulltext/ED066339.pdf>.
- 69 *Id.*
- 70 See A. H. Glenn, *Forecasting for the Offshore Oil Boom*, 2 WEATHERWISE 6 (1949), available at <http://www.tandfonline.com/doi/abs/10.1080/00431672.1949.9925186?journalCode=vwws20>.
- 71 See A. H. Glenn, *Economic Consideration of Certain Weather and Oceanographic Problems Arising in the Petroleum Industry* 7 (1951), available at <https://www.onepetro.org/conference-paper/SPE-152-G>.
- 72 See *id.*
- 73 See Herbert Riehl & Mercer H. Parks, *Hurricane Formation in the Gulf of Mexico* (1963), available at <https://www.onepetro.org/conference-paper/API-63-101>.
- 74 See *id.*
- 75 See M. M. Patterson, *An Ocean Data Gathering Program for the Gulf of Mexico* (1969), available at <https://www.onepetro.org/conference-paper/SPE-2638-MS>.
- 76 See *id.*
- 77 See HAROLD C. UREY ET AL., THE MEASUREMENT OF PALEOTEMPERATURES; SCIENTIFIC REPORT TO THE GEOLOGICAL SOCIETY OF AMERICA, THE AMERICAN PETROLEUM INSTITUTE, AND THE OFFICE OF NAVAL RESEARCH (1950), available at <https://www.osti.gov/scitech/servlets/purl/4423471>.
- 78 See H. R. Brannon et al., *Humble Oil Company Radiocarbon Dates II*, 125 SCI. 919 (1957), available at <http://science.sciencemag.org/content/125/3254/919>.
- 79 See *Carbon Dioxide May Contribute to Hurricanes*, MADERA DAILY NEWS-TRIBUNE, Mar. 15, 1956, available at <https://cdnc.ucr.edu/cgi-bin/cdnc?a=d&d=MT19560315.2.19&e=-----en-20-MT-1--txt-txIN-carbon+dioxide+may+contribute+to+hurricanes-----1>.
- 80 See Lily Rothman, *Scientists Have Known about Climate Change for a Lot Longer Than You May Think*, TIME (Nov. 30, 2015), <http://time.com/4122485/climate-change-history/>.
- 81 See James F. Black & Barry L. Tarmy, *The Use of Asphalt Coatings to Increase Rainfall*, 2(5) J. OF APPLIED METEOROLOGY 557 (1963), available at [http://journals.ametsoc.org/doi/pdf/10.1175/1520-0450\(1963\)002%3C0557%3ATUOACT%3E2.0.CO%3B2](http://journals.ametsoc.org/doi/pdf/10.1175/1520-0450(1963)002%3C0557%3ATUOACT%3E2.0.CO%3B2); Cloud Formation and Subsequent Moisture Precipitation, U.S. Patent No. 3,409,220 (filed Mar. 26, 1965).
- 82 W.M. GRAY ET AL., WEATHER MODIFICATION BY CARBON DUST ABSORPTION OF SOLAR ENERGY. Colorado State Univ. Atmos. Science Paper No. 225 (July 1974); later summarized in 15 J. Applied Meteorology 355-385 (April 1976) avail. online at <http://hurricane.atmos.colostate.edu/Includes/Documents/Publications/grayetal1976.pdf>.
- 83 Joseph Curray, *Late Quaternary Sea Level: A Discussion*, 72 GEOL. SOC. OF AMER. BULL. 1701-1712 (Nov. 1961), available at <https://www.smokeandfumes.org/documents/11>.

- 84 See ELMER ROBINSON & R. C. ROBBINS, SOURCES, ABUNDANCE, AND FATE OF GASEOUS ATMOSPHERIC POLLUTANTS: FINAL REPORT (1968), available at <https://www.osti.gov/scitech/biblio/6852325>.
- 85 See H. H. Meredith, *Platitudes or Performance?*, 16 J. OF THE AIR POLLUTION CONTROL ASS'N 547, 549 (1966), available at <http://www.tandfonline.com/doi/pdf/10.1080/00022470.1966.10468517?needAccess=true>.
- 86 See ROBINSON & ROBBINS, *supra* note 84.
- 87 See *id.* at 108.
- 88 *Id.* at 112.
- 89 See *id.* at 109.
- 90 *Id.*
- 91 *Id.* (emphasis added).
- 92 See ELMER ROBINSON & R. C. ROBBINS, SOURCES, ABUNDANCE, AND FATE OF GASEOUS ATMOSPHERIC POLLUTANTS: SUPPLEMENT (1969), available at <https://www.osti.gov/scitech/biblio/6852325>.
- 93 Global Mean CO₂ Mixing Ratios (ppm): Observations, NASA, <https://data.giss.nasa.gov/modelforce/ghgases/fig1a.ext.txt> (last visited Oct. 27, 2017) (reporting that atmospheric CO₂ reached 370 ppm exactly in the year 2000).
- 94 See Michael Carlowicz, *Global Temperatures*, NASA EARTH OBSERVATORY, <https://earthobservatory.nasa.gov/Features/WorldOfChange/decadaltemp.php> (last visited Nov. 6, 2017).
- 95 Relative to 1965 levels.
- 96 See ROBINSON & ROBBINS, *supra* note 92, at 23.
- 97 *Id.*
- 98 *Id.* at 24.
- 99 *Id.* at 25.
- 100 *Id.*
- 101 *Id.* at 24.
- 102 See Environmental Research: A Status Report (Jan. 1972) (staff paper prepared for the American Petroleum Institute), available at <http://files.eric.ed.gov/fulltext/ED066339.pdf>.
- 103 See *id.* at 103.
- 104 See ENVIRONMENTAL CONSERVATION: THE OIL AND GAS INDUSTRIES / VOLUME 2, NATIONAL PETROLEUM COUNCIL 7 (1972), available at http://www.npc.org/reports/1972-Environmental_Conservation-Oil_and_Gas_Industries-Vol_II.pdf.
- 105 See NATIONAL PETROLEUM COUNCIL, <http://www.npc.org/> (last visited Nov. 1, 2017).
- 106 See ENVIRONMENTAL CONSERVATION, *supra* note 104.
- 107 See *id.* at 7.
- 108 *Id.* at 11.
- 109 See AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, AIR CONSERVATION 78-82 (1965).
- 110 See Memorandum from James F. Black, Scientific Advisor, Exxon Products Research Division, to F. G. Turpin, Vice President, Exxon research and Engineering Co. (Jun. 6, 1978) (on file with InsideClimate News) [hereinafter Black Memorandum], available at <https://insideclimatenews.org/sites/default/files/documents/James%20Black%201977%20Presentation.pdf>.
- 111 See Memorandum from Henry Shaw to John W. Harrison, regarding "Environmental Effects of Carbon Dioxide" 3 (Oct. 31, 1977) (on file with InsideClimate News), available at <https://insideclimatenews.org/sites/default/files/documents/Government%20Meeting%20Memo%20%281977%29.pdf>.
- 112 See Memorandum from James F. Black, *supra* note 110, at 1.
- 113 See *id.* at 2.
- 114 See Memorandum from Henry Shaw to T. K. Kett on "Exxon Research & Engineering Company Technological Forecast: CO₂ Greenhouse Effect" 2 (Dec. 18, 1980) (on file with InsideClimate News), available at <https://insideclimatenews.org/sites/default/files/documents/Technological%20Forecast%20on%20CO2%20Greenhouse%20Effect%201980.pdf>.
- 115 *Id.*
- 116 See Letter to API Climate Task Force on "The CO₂ problem; Addressing Research Agenda Development" (Mar. 18, 1980) (on file with Climate Files), available at <http://www.climatefiles.com/exxonmobil/1980-api-climate-task-force-co2-problem/>.
- 117 See Brendan DeMelle & Kevin Grandia, "There is no doubt": Exxon Knew CO₂ Pollution Was A Global Threat By Late 1970s, DESMOG BLOG (Apr. 26, 2016, 9:19 AM), <http://www.desmogblog.com/2016/04/26/there-no-doubt-exxon-knew-co2-pollution-was-global-threat-late-1970s>.
- 118 Memorandum from Henry Shaw, Exxon, to Dr. E. E. David, Jr., Exxon (May 15, 1981) (on file with InsideClimate News), available at <https://insideclimatenews.org/sites/default/files/documents/Exxon%20Position%20on%20CO2%20%281981%29.pdf>.
- 119 Memorandum from Roger W. Cohen, Theoretical and Mathematical Sciences Laboratory, Exxon, to A. M. Natkin, Office of Science and Technology, Exxon (Sept. 2, 1982) (on file with InsideClimate News), available at <https://insideclimatenews.org/sites/default/files/documents/%2522Consensus%2522%20on%20CO2%20Impacts%20%281982%29.pdf>.
- 120 See *id.*
- 121 *Id.*
- 122 See Memorandum from M. B. Glaser, Manager, Environmental Affairs Programs, Exxon (Nov. 12, 1982) (on file with InsideClimate News), available at <https://insideclimatenews.org/sites/default/files/documents/1982%20Exxon%20Primer%20on%20CO2%20Greenhouse%20Effect.pdf>.
- 123 See Sara Jerving, Katie Jennings, Masako Melissa Hirsch, & Susanne Rust, *How Exxon Went From Leader to Skeptic on Climate Change Research*, L.A. TIMES (Oct. 9, 2015), <http://graphics.latimes.com/exxon-arctic/>.
- 124 *Id.*
- 125 Damian Carrington & Jelmer Mommers, 'Shell Knew': Oil Giant's 1991 Film Warned of Climate Change Danger, THE GUARDIAN (Feb. 28, 2017), <https://www.theguardian.com/environment/2017/feb/28/shell-knew-oil-giants-1991-film-warned-climate-change-danger>.
- 126 See Amy Lieberman & Suzanne Rust, *Big Oil Braced for Global Warming While it Fought Regulations*, L.A. TIMES (Dec. 31, 2015), <http://graphics.latimes.com/oil-operations/>.
- 127 See *id.*
- 128 See Die geheimen Machenschaften der Ölindustrie (The Secret Machinations of the Oil Industry), Westdeutscher Rundfunk (2017).
- 129 See Jerving et al, *supra* note 123.
- 130 *Id.*
- 131 Jeremy Leggett, *The Carbon War* (1999) (attributing the following statement to Exxon scientist Brian Flannery during the final drafting session for the IPCC's Scientific Assessment Report: "The range of model results isn't any better justified than it was ten years ago. The range is quite scientifically uncertain. This should be stated as such in the executive summary.")
- 132 See KATHY MULVEY & SETH SHULMAN, UNION OF CONCERNED SCIENTISTS, THE CLIMATE DECEPTION DOSSIERS: INTERNAL FOSSIL FUEL INDUSTRY MEMOS REVEAL DECADES OF CORPORATE DISINFORMATION 34 (2015), available at <http://www.ucsusa.org/sites/default/files/attach/2015/07/The-Climat-Deception-Dossiers.pdf>.
- 133 Andrew Revkin, *Industry Ignored its Scientists on Climate*, N.Y. TIMES (April 23, 2009) <http://www.nytimes.com/2009/04/24/science/earth/24deny.html>.
- 134 See *id.*
- 135 *Id.*
- 136 See NAOMI ORESKES & ERIK M. CONWAY, MERCHANTS OF DOUBT 205-09 (2010).
- 137 See *id.* at 207.
- 138 See *id.* For a longer, contemporary discussion of these events, see WILLIAM K. STEVENS, THE CHANGE IN THE WEATHER: PEOPLE, WEATHER, AND THE SCIENCE OF CLIMATE 129-31 (1999).
- 139 See Suzanne Goldenberg, *The Inside Story on Climate Scientists Under Siege*, THE GUARDIAN (Feb. 17, 2012, 7:28 PM), <https://www.theguardian.com/environment/2012/feb/17/michael-mann-climate-war>.
- 140 Global Climate Science Communications Action Plan (1998), available at <https://insideclimatenews.org/documents/global-climate-science-communications-plan-1998>. First published in UNION OF CONCERNED SCIENTISTS, SMOKE, MIRRORS & HOT AIR 37 (2007), available at http://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/exxon_report.pdf.
- 141 *Id.*
- 142 EXXONMOBIL, GLOBAL CLIMATE CHANGE: THE OP-ED SERIES (2000), available at <https://www.documentcloud.org/documents/2805611-2000-Oped-Series-Global-Climate-Change-Exxon.html#document/p5>.
- 143 *Id.*
- 144 See Kert Davies, *Willie Soon Scandal: Corporate Funding Year By Year*, CLIMATE INVESTIGATIONS CENTER (Feb. 27, 2015), <http://climateinvestigations.org/willie-soon-scandal-corporate-funding-year-by-year/>. See also MULVEY & SHULMAN, *supra* note 132, at 14.
- 145 See *id.*
- 146 See *id.*
- 147 *Id.*
- 148 *Id.* at 39.
- 149 *Id.*
- 150 For a more extensive discussion of climate denial by the U.S. coal industry, see ORESKES & CONWAY, *supra* note 136, at 169-215.

- 151 See MULVEY & SHULMAN, *supra* note 132, at 19.
- 152 See *Greening Earth Society*, DESMOG BLOG, <https://www.desmogblog.com/greening-earth-society> (last visited Nov. 3, 2017); for a useful overview of various Western Fuels climate denial campaigns active in the 1990s and into the 2000s, see Center for Environmental Advocacy and Research, Western Fuels Association's Astroturf Empire Coal Industry Campaign Multiplies Efforts to Re-Spin Global Warming, (Nov. 10, 1998), available at https://web.archive.org/web/20020629002337/http://clearproject.org/reports_westernfuels.html.
- 153 See MULVEY & SHULMAN, *supra* note 132, at 25.
- 154 See Suzanne Goldenberg & Helena Bengtsson, *Biggest US Coal Company Funded Dozens of Groups Questioning Climate Change*, THE GUARDIAN (Jun. 13, 2016, 6:00 AM), <https://www.theguardian.com/environment/2016/jun/13/peabody-energy-coal-mining-climate-change-denial-funding>; Nick Surgey, *Bankruptcy Filing Shows Arch Coal Funding for Climate Denial Legal Group*, PRWATCH (Feb. 24, 2016, 8:33 AM), <http://www.prwatch.org/news/2016/02/13049/bankruptcy-documents-indicate-arch-coal-funding-climate-denial-legal-group>; *Coal Companies' Secret Funding of Climate Science Denial Exposed*, UNION OF CONCERNED SCIENTISTS (Apr. 2016), <http://www.ucsusa.org/publications/got-science/2016/got-science-april-2016#.WJpclX8pIVg>.
- 155 MULVEY & SHULMAN, *supra* note 132, at 16-18.
- 156 ExxonMobil, *Energy and Climate* (2014), available at <http://cdn.exxonmobil.com/-/media/global/files/energy-and-environment/report---energy-and-climate.pdf>.
- 157 *Id.* (emphasis added).
- 158 See Carrington & Mommers, *supra* note 125.
- 159 See Dana Nuccitelli, *New Studies Show Rex Tillerson is Wrong About Climate Risks*, THE GUARDIAN (Jan. 16, 2017), <https://www.theguardian.com/environment/climate-consensus-97-per-cent/2017/jan/16/new-studies-show-rex-tillerson-is-wrong-about-climate-risks>.
- 160 See Geoffrey Supran & Naomi Oreskes, *Assessing ExxonMobil's Climate Change Communications (1977-2014)*, ENVTL. RES. LETTERS, Aug. 23, 2017, available at <http://iopscience.iop.org/article/10.1088/1748-9326/aa815f>.
- 161 *Id.*
- 162 *Id.*
- 163 *Id.* See also Geoffrey Supran & Naomi Oreskes, *What Exxon Mobil Didn't Say About Climate Change*, N.Y. TIMES (Aug. 22, 2017), available at https://www.nytimes.com/2017/08/22/opinion/exxon-climate-change.html?_r=0.
- 164 See Justin Gillis & Clifford Krauss, *Exxon Mobil Investigated for Possible Climate Change Lies by New York Attorney General*, N.Y. TIMES (Nov. 5, 2015), available at <https://www.nytimes.com/2015/11/06/science/exxon-mobil-under-investigation-in-new-york-over-climate-statements.html>.
- 165 See Diane Cardwell & John Schwartz, *Exxon Emissions Costs Accounting 'May Be a Sham,' New York State Says*, N.Y. TIMES (June 2, 2017), available at <https://www.nytimes.com/2017/06/02/business/energy-environment/exxon-mobil-climate-change-lawsuit.html>.
- 166 See David Hasemyer, *Exxon May Have Erased 7 Years of Tillerson's 'Wayne Tracker' Emails, Witness Says*, INSIDECLIMATE NEWS (June 8, 2017), <https://insideclimatenews.org/news/08062017/exxon-climate-fraud-rex-tillerson-erased-wayne-tracker-emails-witness>.
- 167 *See id.*
- 168 *See id.*
- 169 See Examination of Michelle Hirshman at 141-42, Matter of the Investigation of Exxon Mobil Corporation (N.Y. Sup. Ct. June 2, 2017) (No. 451962/2016) (noting that the Wayne Tracker email address was not subject to a preservation hold), available at <http://www.documentcloud.org/documents/3860668-Documents-185-Transcript-of-Deposition-of-Exxon.html>. See also Carroll Muffett, *Why the Exxon Investigation is More Urgent and More Justified than Ever*, ALTERNET (July 19, 2017, 11:30 PM), <https://www.alternet.org/environment/why-exxon-investigation-more-urgent-and-more-justified-ever>.
- 170 See Examination of Connie Feinstein at 71, Matter of the Investigation of Exxon Mobil Corporation (N.Y. Sup. Ct. June 2, 2017) (No. 451962/2016), available at <https://www.documentcloud.org/documents/3860303-Documents-194-Transcript-of-Exxon-Techie-Connie.html>.
- 171 See Memorandum of Law in Opposition to Exxon's Motion to Quash and in Support of the Office of the Attorney General's Cross-Motion to Compel at 12, n. 12, *New York v. PriceWaterhouseCoopers* (N.Y. Sup. Ct. June 2, 2017) (451962/2016).
- 172 See Examination of Michelle Hirshman, *supra* note 169, at 37.
- 173 *Id.* at 135-36.
- 174 Production of Pure Carbon Dioxide, U.S. Patent No. 2,665,971 (filed May 12, 1949).
- 175 Method for Recovering a Purified Component from a Gas, U.S. Patent No. 3,228,874 (filed Aug 22, 1961).
- 176 Process for the Removal of Acidic Gases from a Gas Mixture, U.S. Patent No. 3,760,564 (filed Mar. 20, 1972).
- 177 Petroleum Recovery with Inert Gases, U.S. Patent No. 3,193,006 (filed Nov. 3, 1961).
- 178 Recovery of Shale Oil, U.S. Patent No. 3,516,495 (filed Nov. 29, 1967).
- 179 See DeMelle & Grandia, *supra* note 117.
- 180 See *Carbon Capture and Storage a Costly, Risky Distraction*, GREENPEACE (July 1, 2016), <http://www.greenpeace.org/international/en/campaigns/climate-change/Solutions/Reject-false-solutions/Reject-carbon-capture--storage/> (noting that carbon capture and storage technology is expensive, has led to unnatural earthquakes, and has other technical implementation problems which have led to Norway, the United States, the European Union, and the United Kingdom, among others, to cancel high-profile carbon capture and storage projects).
- 181 See *id.* (noting examples in Salah, Algeria, the Norwegian North Sea, and Mississippi, United States, where carbon capture and storage attempts have led to cracks in rock formations, indicating likely future leakage, or actual leakage events).
- 182 Direct Production of Electrical Energy from Liquid Fuels, U.S. Patent No. 3,113,049 (filed Jan. 3, 1961); Fuel Cell and Fuel Cell Electrodes, U.S. Patent No. 3,116,169 (filed Mar. 14, 1960); Fuel Cell Catalysts, U.S. Patent No. 3,239,382 (filed Sept. 27, 1960); Fuel Cell With Pr-Au Anode and Molybdate-Containing Electrolyte, U.S. Patent No. 3,443,998 (filed Jul. 5, 1963); Low-Polluting Engine and Drive System, U.S. Patent No. 3,513,929 (filed Aug. 25, 1967).
- 183 See generally S.G. Meibuhr, *Review of United States Fuel-Cell Patents Issued During 1963 and 1964*, 11(9) ELECTROCHIMICA ACTA 1325 (1966), available at <http://www.sciencedirect.com/science/article/pii/001346866870317>.
- 184 See *Electric Vehicles and Other Alternatives to the Internal Combustion Engine: Hearing on S. 451 and S. 453 Before the S. Comm. on Commerce and the S. Subcomm. on Air and Water Pollution of the S. Comm. on Pub. Works*, 90th Cong. 316-19 (1967) (statement of Robert Dunlop, Chairman, Board of Directors, American Petroleum Institute).
- 185 See, e.g., High Efficiency Selenium Heterojunction Solar Cells, U.S. Patent No. 4,064,522 (filed Feb. 4, 1976); Solar Cell Module, U.S. Patent No. 4,235,643 (filed June 30, 1978); Solar Cell Assembly and fabrication of Solar Cell Panels Utilizing Same, U.S. Patent No. 4,287,382 (filed May 9, 1980); Indium Oxide/N-Silicon Heterojunction Solar Cells, U.S. Patent No. 4,366,335 (filed Apr. 30, 1981); Thin Film Solar Cell Substrate, U.S. Patent No. 4,510,344 (filed Dec. 19, 1983).
- 186 See Tracy Emblem, *How Big Oil had Controlled the Solar Industry*, SAN DIEGO UNION-TRIBUNE (Apr. 17, 2011), <http://www.sandiegouniontribune.com/sdut-how-big-oil-had-controlled-the-solar-industry-2011apr17-story.html>.
- 187 For an extensive review of the oil industry's role in the solar industry during this period, including a discussion of how the industry captured vital subsidies, see Geoffrey Jones & Loubna Bouamane, *"Power from Sunshine": A Business History of Solar Energy 21-38* (Harvard Bus. Sch., Working Paper No. 12-105, 2012), available at <http://www.hbs.edu/faculty/Publication%20Files/12-105.pdf>.
- 188 See generally *id.*; Emblem, *supra* note 186.
- 189 See, e.g., GERALD MARKOWITZ and DAVID ROSNER, *DECEIT AND DENIAL: THE DEADLY POLITICS OF INDUSTRIAL POLLUTION* (Univ. of California Press, 2002); James Lincoln Kitman, *The Secret History of Lead*, THE NATION (March 2, 2000) <https://www.thenation.com/article/secret-history-lead/>; see also discussion *infra*.
- 190 See, e.g., CHIP JACOBS, WILLIAM J. KELLY, *SMOGTOWN: THE LUNG-BURNING HISTORY OF POLLUTION IN LOS ANGELES* (2008); Devra Davis, *When Smoke Ran Like Water: Tales of Environmental Deception and the Battle Against Pollution* (2003) (*passim*); JAMES E. KRIER, *POLLUTION AND POLICY: A CASE ESSAY ON CALIFORNIA AND FEDERAL EXPERIENCE WITH MOTOR VEHICLE AIR POLLUTION, 1940-1975* (1977); and discussion *supra* notes 49-69 and accompanying text.
- 191 Jennifer Beth Sass, Barry Castleman, and David

- Wallinga, *Vinyl Chloride: A Case Study of Data Suppression and Misrepresentation*, 113 ENVTL. HEALTH PERSP. 809 (Mar. 24, 2005) available at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1257639/>; Ugo Fedeli and Giuseppe Mastrangelo, *Vinyl Chloride Industry in the Courtroom and Corporate Influence on Scientific Literature*, 54 AM. J. INDUS. MED. 470 (2011) available at <http://onlinelibrary.wiley.com/doi/10.1002/ajim.20941>; CHEMICAL INDUSTRY ARCHIVES, <http://www.chemicalindustryarchives.org> (last visited Nov. 15, 2017). See also 11-part review of *Vinyl Chloride Conspiracy Documents*, JON L. GELMAN: ATTORNEY AT LAW <https://www.gelman.com/ReadingRoom/tabid/65/ctl/CategoryView/mid/372/categoryId/6/Vinyl-Chloride-Cancer.aspx> (last visited Nov. 15, 2017).
- 192 See, e.g., Kristen Lombardi, "Inside the Petrochemical Industry's \$36m 'Research Strategy' on Ubiquitous Poison Benzene," THE GUARDIAN (Dec. 4, 2014) available at <https://www.theguardian.com/environment/2014/dec/04/-sp-documents-petrochemical-industry-poison-benzene>; *Exposed: Decades of Denial on Poisons*, CENTER FOR PUBLIC INTEGRITY, <https://www.publicintegrity.org/2014/11/23/16319/exposed-decades-denial-poisons> (last visited Nov. 15, 2017).
- 193 See *Smoke & Fumes (Smoke)*, CENTER FOR INTERNATIONAL ENVIRONMENTAL LAW (2016), available at <https://www.smokeandfumes.org/smoke>; Benjamin Hulac, *Tobacco and Oil Industries Used Same Researchers to Sway Public*, SCIENTIFIC AMERICAN (July 20, 2016) available at <https://www.scientificamerican.com/article/tobacco-and-oil-industries-used-same-researchers-to-sway-public/>.
- 194 See, e.g., Letter of William W. Shinn to Thomas Arensfeld et al., (March 1, 1972) (on file with University of California, San Francisco), available at <https://www.industrydocumentslibrary.ucsf.edu/tobacco/docs/#id=yxvh0128>. See generally discussion and documents at *Theodor Sterling*, SMOKE AND FUMES, <https://www.smokeandfumes.org/smoke/moments/20> (last visited Nov. 15, 2017).
- 195 See Robert T. P. DeTreville et al., *Occupational Exposure to Organic Lead Compounds*, 5 J. OF OCCUPATIONAL AND ENVTL. MED. 229 (1962), available at <http://www.tandfonline.com/doi/abs/10.1080/00039896.1962.10663326>; journalCode=vzeh20. See also Theodor Sterling et al., *Mathematical Analysis of Lead Burdens*, 8 ARCHIVES OF ENVTL. HEALTH 44 (1964), available at <http://www.tandfonline.com/doi/abs/10.1080/00039896.1964.10663630>; journalCode=vzeh20.
- 196 See Theodor Sterling, Report and Recommendations of the Advisory Panel to the Feasibility Study (report commissioned by tobacco industry) (on file with University of California, San Francisco), available at <https://www.industrydocumentslibrary.ucsf.edu/tobacco/docs/#id=pkyx0119>.
- 197 See Theodor Sterling, The Feasibility of a Definitive Evaluation of the Data Concerning Smoking and General Morbidity and Disability: Status Report (report commissioned by tobacco industry) (on file with University of California, San Francisco), available at <https://www.industrydocumentslibrary.ucsf.edu/tobacco/docs/#id=xxhl0040>.
- 198 See Sterling, *supra* note 196.
- 199 See *id.*
- 200 See Laundered Research (Feb. 11, 1975) (on file with University of California, San Francisco), available at <https://www.industrydocumentslibrary.ucsf.edu/tobacco/docs/#id=rybl0004>.
- 201 See, e.g., Memorandum from David E. Townsend, RJR, to M. E. Stowe, (Nov. 30, 1978) (on file with University of California, San Francisco), available at <https://www.industrydocumentslibrary.ucsf.edu/tobacco/docs/#id=pkyf0082>; memorandum from R. L. Johnson to W. L. DeWitt (Mar. 13, 1975) (on file with University of California, San Francisco), available at <https://www.industrydocumentslibrary.ucsf.edu/tobacco/docs/#id=tspm0139>; proposal for research prepared by Edward M. Liston et al., Stanford Research Institute (Dec. 9, 1975) (on file with University of California, San Francisco), available at <https://www.industrydocumentslibrary.ucsf.edu/tobacco/docs/#id=mzbm0088>.
- 202 See CORPORATE EUROPE OBSERVATORY, CONCEALING THEIR SOURCES – WHO FUNDS EUROPE'S CLIMATE CHANGE DENIERS? 2 (2010), available at https://corporateeurope.org/sites/default/files/sites/default/files/files/article/funding_climate_deniers.pdf.
- 203 See *id.* at 3.
- 204 See *id.* at 9.
- 205 See *id.* at 5.
- 206 See generally, *id.*
- 207 See *id.* at 5.
- 208 See *id.* at 4.
- 209 See *id.*
- 210 See *id.* at 5.
- 211 See *id.* at 7.
- 212 See *id.* at 4.



SMOKE AND FUMES

The Legal and Evidentiary Basis for Holding Big Oil Accountable for the Climate Crisis

Smoke and Fumes: The Legal and Evidentiary Basis for Holding Big Oil Accountable for the Climate Crisis presents a comprehensive synthesis of the available evidence on what the oil industry knew about climate science, when they knew it, and what they did with the information. It combines that synthesis with an update on the latest developments in accountability research and science, which have dramatically improved our ability to identify the impacts of climate change on individuals and communities, the corporate actors that contributed to those impacts, and the nature of their contributions. The report presents this evidence in the context of the core elements of legal responsibility in tort and human rights law. It concludes that oil industry actors had early knowledge of climate risks and important opportunities to act on those risks, but repeatedly failed to do so. Those failures give rise to potential legal responsibilities under an array of legal theories.



1101 15th Street NW, 11th Floor
Washington, DC 20005 USA

Phone: (202) 785-8700 • www.ciel.org