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Ocean Iron Fertilization: A Case Study of Geoengineering's Regulatory Challenges

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EXECUTIVE SUMMARY

Scientists and private companies are increasingly testing the viability of ocean iron fertilization (OIF) as a large-scale climate change mitigation technique, sparking enormous worldwide controversy. This memo argues that before OIF experimentation proceeds further, United States federal and state government agencies must: 1) assess laws, rules, and bureaucratic practices related to reviewing these experiments; 2) ensure that these laws, rules, and bureaucratic practices are adequate to deal with the unique challenges posed by OIF; and 3) require that these laws, rules, and practices cover both small-scale experimentation and large-scale deployment of OIF.

A robust and comprehensive national legal environment is needed to regulate OIF in the US. While OIF regulation is often discussed in terms of international governance, an international approach will not work for the US for two reasons. First, the US is not bound to most relevant international laws regarding OIF. Second, the little international regulation that binds the US is inherently contradictory. Because of the complicated nature of regulation in international waters, any future regulation of OIF will have to navigate both the national and international legal environments. While OIF is often proposed as a viable geoengineering method (Lampitt et al, 2008; Royal Society, 2009), this framing misses critical concerns regarding OIF. We make three recommendations to fix these problems: 1) expand the range of expertise currently consulted in the permitting processes; 2) require an additional assessment, an International Impact Assessment, to investigate potential international ramifications of any proposed OIF project; and 3) create a public clearinghouse in the form of a website for all permitting documents to ensure transparency and encourage greater public engagement.

Background

Ocean iron fertilization (OIF) is a carbon capture and sequestration geoengineering technique (Powell, 2007; Buesseler, 2004; Coale, 1996). It works by increasing the local concentration of iron, a limiting nutrient, in a patch of surface seawater to encourage algae growth, which removes carbon dioxide from the atmosphere. In theory, the algae then die and sink to the ocean bottom, thus removing carbon from the atmosphere (Martin, et al, 1994). Because of the simplicity of its application, commercialized OIF is likely to become operational on a large scale in the very near future. Several OIF projects funded by US agencies are already underway and US private companies are actively seeking to commercialize OIF (Rusco, 2010). Planktos, a U.S.-based ocean biotechnology company, began selling carbon offsets from OIF in 2007 (ETC Group and ITCA, 1997).

Scientists have performed multiple OIF experiments worldwide since 1993 (Boyd, 2007; Bhattacharya, Jan 14, 2009). One of the most recent of these, LOHAFEX, generated significant public outcry (WWF, 2009; Bhattacharya, Jan. 27, 2009). LOHAFEX was an international OIF project led by the German and Indian governments with scientists from the Alfred Wegener Institute in Germany and the National Institute of Oceanography of India (NIO 2009). It took place in the southwestern Atlantic Ocean and "fertilized" a patch of 300 km^2. International environmental NGOs including Hands Off Mother Earth, ETC Group, Greenpeace, and Indian and South African activists, objected strongly to the experiment and launched major campaigns in opposition (ASOC, 2009; ETC Group, 2009). Surprised by the public outcry, the German Research Ministry (BMU) recalled the project to its' South African port (ASOC, 2009). The opposition from international environmental groups nearly derailed the project entirely, catching those implementing the experiment off-guard.

While researchers ultimately completed LOHAFEX, opposition to OIF has continued to grow. The Convention on Biological Diversity (CBD), an international body within the United Nations responsible for protection of oceans, among other things, is considering instituting an official moratorium on all OIF projects (Madrigal, 2009). Additionally, advocacy groups, including those who mobilized to fight LOHAFEX, have increased their opposition (Mooney, May 30, 2010). We can easily conclude that the growing controversy over OIF will affect future projects within the US.

The Current International Law Structure

While OIF regulation is often discussed in international terms (Bertram, 2009; Güssow, 2010), regulation of such a technique will also require effective federal and state governance structures in the US. There are two reasons for this: first, the US is largely not bound to the relevant international laws, and second, the few binding laws are conflicting and difficult to enforce.

The US is largely not subject to the CBD[1] or the London Convention/London Protocol[2], which are the two international treaties that govern oceans. While the US has signed the CBD,

[1] The CBD is a legally binding international treaty signed by 191 nations, including the United States. Its goal is to protect a broad definition of biological diversity around the globe. The CBD endorsed a moratorium on large-scale OIF operations in 2008, and will consider a proposal from a scientific subcommittee to require a moratorium on all OIF operations later this year.

the US Senate has not yet ratified it (Convention, 2010). In contrast, the London Convention was signed and ratified by the US in 1975 (US EPA, 2006). However, the London Protocol, amendments intended to update the Convention's provisions, have not yet been ratified by the US Senate (WRI, 2006). Thus the US is neither bound to nor protected by the majority of international law in this arena. Because the international domain is problematic for the US, national laws will have to govern OIF.

While the London Convention/London Protocol provides a framework for countries to attempt to regulate ocean activities, they are unlikely to play a major role in the development of US OIF regulation policy because they conflict. The London Protocol contains a specific exemption for ocean research, while the CBD does not (Climos, 2008). In addition, "research" is not explicitly defined in either treaty. Thus, the question of what constitutes research vs. implementation of OIF remains open. The 300 square kilometers used in LOHAFEX may be insignificant compared to the size of the ocean at large, but it is the largest OIF experiment performed to date (ASOC, 2010). At what size or for what purpose should experimentation be reclassified as implementation? So far, international law provides no clues in making this differentiation, and there are powerful interests on either side of the debate trying to influence the definition of "research" in this context (Leinen, 2008; Allsopp, 2007). Thus, these treaties are insufficient to govern the development of an OIF regulatory regime in the US.

Regulating OIF Using a National Legal Framework

Translational Issues: National Laws, International Problems

Using national laws to address an international regulatory problem is complicated. International laws can be difficult to translate to the national stage. To effectively deal with this issue, several questions must be addressed in the course of crafting OIF regulation in the US:

- *What impact will growing political opposition have on regulation?* Many opponents of LOHAFEX also operate in the U.S., making it likely opposition efforts would be pursued against any U.S.-funded experiments.
- *How can national laws deal with a technology with international effects?* Geoengineering in general, and OIF specifically, are by their very nature international technologies; they take place in international waters (often involving multiple countries through international crews and researchers, with boats registered to one country while operating from another), and have the potential to effect a global population.
- *What authority will US regulation have over US companies operating outside US territorial waters?* The current US regulatory structure only applies to operations within the boundaries of the US. For OIF regulation to be effective, US companies must be bound to the US framework regardless of their operational location or port of origin.
- *How can regulation address potential national security, human health and ecosystem impacts of OIF?* The actions of US companies can have serious implications for American foreign policy, health and environmental concerns in the areas where experimentation and implementation occur.

[2] The London Convention, and its associated amendments in the London Protocol, is a second international treaty that specifically covers ocean dumping. The Convention itself provides a global framework for regulation of dumping activities, which would include OIF. However, the Protocol contains a specific exemption for OIF research experiments, further complicating the international legal landscape.

- *How can OIF regulation be incorporated into existing regulatory structures?* It is more feasible to incorporate OIF regulation into existing laws and agency practices. What current laws and bureaucratic practices are relevant to OIF?

Two regulatory frameworks have the potential to govern US ocean fertilization: the National Environmental Protection Act (NEPA), which would cover experimentation by federal agencies, and the Marine Protection, Research and Sanctuaries Act which would cover the actions of private companies (GAO, 2010). Yet, in their current state, neither of these laws will adequately regulate ocean fertilization.

The National Environmental Protection Act (NEPA)

Passed into law in 1970, NEPA established environmental policy and goals for the United States (US EPA, 2010). The NEPA process can be broken down into three levels of analysis, corresponding to three different levels of risk: low, medium and high (US EPA, 2010).

A **Categorical Exclusion (CE)** is given to proposals that "…do not individually or cumulatively have a significant effect on the human environment ... and ... for which, therefore, neither an environmental assessment nor an environmental impact statement is required" (FHWA, 2010). The CE allows agencies to eliminate low risk projects from further analysis by evaluating each project against criteria, informed by knowledge gained from past projects, which indicate a finding of no significant impact (FONSI) (US EPA, 2010). To meet these criteria, a project must not (FHWA, 2010):

- Induce significant impacts to planned growth or land use for the area
- Require the relocation of significant numbers of people
- Have a significant impact on any natural, cultural, recreational, historic or other resource
- Involve significant air, noise, or water quality impacts
- Have significant impacts on travel patterns
- Either individually or cumulatively, have any significant environmental impacts

Most agencies have established lists that include past projects with a FONSI, which are used to cross reference and categorically exclude current proposals (US EPA, 2010). For example, the Department of Energy lists actions to conserve energy and adding or burying fiber optic cable as excluded activities (US DOE, 2010).

For those projects that do not receive a Categorical Exclusion the proposing agency must prepare an **Environmental Assessment (EA)**. An EA is a tool to determine the environmental consequences of proposed federal projects. Each EA includes information regarding (US EPA, 2010):

- The need for the proposal
- Alternatives
- The environmental impacts of the proposed action and alternatives

The EA allows the proposing agency another opportunity to determine whether or not the project has a FONSI or whether it must go on to the more rigorous evaluation of the Environmental Impact Statement (EIS) (USBR, 2010). Agencies are not required to prepare an EA if they have already planned to carry out an EIS (US GPO, 2010).

The **Environmental Impact Statement (EIS)** can be thought of as an enforcement mechanism in response to an EA that indicates a finding of significant environmental impact. An EIS is a more detailed evaluation than an EA of the potential environmental impacts of a project. An EIS includes discussions of (US EPA, 2010):

- The purpose of and need for the proposal

- Alternatives
- The affected environment, and
- The environmental consequences of the proposal

Once the three levels of analyses are completed, the EPA reviews the EIS and allows public comment. The public is invited to provide input on the findings in an agency's NEPA documents, to attend hearings or public meetings and submit comments (US EPA, 2010). Lastly, the EPA makes a final determination based on EIS evidence and public consultation. One can easily conclude that given the uncertainties surrounding OIF, it would require an EA and an EIS.

NEPA Process & Intent

Although NEPA provides a rigorous procedure for agencies to adopt in their planning processes, the law is limited in its application (Jay et al., 2007; Cashmore, Bond, Cobb, 2007). First, scholars have found that for most agency bureaucrats, environmental assessment tools such as those required by NEPA are considered a "contributing factor" to decision-making rather than integrated into the institution in which they make decisions (Jay et al., 2007). This is problematic because without institutional integration, NEPA becomes more focused on following procedures than providing a sustainable approach to environmental conservation (Cashmore, Bond, Cobb, 2007). Although some will argue that the NEPA process facilitates more nuanced thinking and action surrounding environmental impacts, many agencies focus on and worry about the inconvenience of the process (Caldwell, 1998). Without buy-in from the bureaucracy, NEPA will never be used to accomplish its full legislative intent.

The Marine Protection, Research and Sanctuaries Act (Ocean Dumping Act)

The second legislative tool for addressing OIF is the Ocean Dumping Act (ODA), which is part of the Marine Protection, Research and Sanctuaries Act. The ODA became law in 1972 and, "prohibits the dumping of material into the ocean that would unreasonably degrade or endanger human health or the marine environment" (US EPA, 2009).

The first title of the ODA restricts dumping from U.S. flagged vessels and of materials transported from a location outside the U.S. Dumping is also prohibited in U.S. territorial waters and their contiguous zone (US Senate, 1972). Perhaps surprisingly, ODA does allow dumping when specially permitted by the EPA. The permitting criteria include (US EPA, 2007):

- The environmental impact of dumping
- The need for dumping
- The effects of the dumping on aesthetic, recreational or economic value, and
- The adverse effects of the dumping on other uses of the ocean

All proposed dumping materials must also undergo testing and evaluation for toxicity and bioaccumulation. These tests and evaluations are meant to provide "scientifically sound" evidence regarding effects on human health and the environment of dumping the proposed material (US EPA, 2007). For example, the EPA has permitted dumping of human remains and fish wastes, and the most commonly dumped material is sediment from the bottom of bodies of waters (US EPA, 2007).

In late 2008, The London Convention/London Protocol exempted scientific research on ocean fertilization from international dumping laws (Climos, 2008). Although the US is not a party to this particular exemption (WRI, 2006), the exemption complicates the enforcement of the Ocean Dumping Act by setting a precedent that challenges the international legitimacy of the

EPA's permitting process as it relates to OIF. Furthermore, this decision, as described above, is extremely controversial and not altogether clear. Now is the time to address this new regulatory and legitimacy gap.

Risk Analysis Reveals Key Flaws in NEPA Efforts Regarding OIF

Although some have argued that OIF poses *de minimis* risk, that argument is rooted in a desire to perform more experiments rather than researchers having any substantive, long term knowledge of the low risk of OIF (Parks, 2008). At the time LOHAFEX took place, it was only the 13th OIF experiment (Bhattacharya, 2009). The prior experiments produced mixed results, which allowed some members of the scientific community to argue in favor of more and larger experiments (Parks, 2008; Boyd et al., 2007). Yet, the most recent OIF experiment indicated high levels of risks including the growth of a neurotoxin, which has proven harmful to fish, birds and humans, and that raises questions regarding the need for and health implications of more experimentation (Marshall, 2010; Munro, 2010).

No scientist truly understands the risks of OIF because none of the experiments have been longitudinal. Instead, OIF experimentation is performed in isolated areas for set amounts of time that are not representative of the risk caused by increasing iron levels in the ocean and do not provide enough data to meaningfully lessen the uncertainty of such activity. Thus, OIF should be considered a high risk NEPA project and be subject to the EIS process. However, some of the greatest flaws in the EIS process are magnified and become increasingly threatening when applied to OIF.

Dependence on Alternatives

The consideration of alternatives is at the heart of every EIS (US CEQ, 2010). Yet, an emphasis on alternatives assumes that geoengineering is acceptable in the first place— implying that the EIS is just a matter of determining the type of technology that is best. Yet, because the public is so uninformed about geoengineering, that assumption takes much for granted (Mooney, 2007).

Further, a range of possible alternatives exist and it is not clear that all alternatives are subject to the same level of scrutiny (Alexander, 2008). One of NEPA's serious flaws is that it does not define or discuss the extent of seriously considered alternatives (Caldwell, 1998). Also, a focus on alternatives-driven evaluation is not a plausible approach for ocean fertilization because many of the geoengineering alternatives to OIF are so potentially risky they have yet to be deployed, and thus have not been evaluated for risk (Rendon, 2010).

Finally, despite NEPA's emphasis on alternatives, they are often not seriously considered. "A weakness in achieving the NEPA objective is the tendency in some agencies to adopt a preferred proposal and plan of action before alternatives are considered" (Caldwell, 1998). If agencies have decided their proposal is what they must have, they are unlikely to put the necessary due diligence into researching and suggesting appropriate alternatives to the proposal. The NEPA process would be better served through placing the power to craft alternatives to proposals in the hands of the EPA, rather than the proposing agency.

"Techno-Rational Decision Making"

Although technical bureaucracies are often viewed as immune to politics, the role of individual beliefs and biases in the formation of an EIS is of critical concern as it relates to OIF. The NEPA process is based on the idea of "techno-rational decision making" which assumes that decisions, made by bureaucrats with technical expertise, are completely objective (Jay et al., 2007). Yet, this seems nearly impossible in the case of OIF simply because the technology is so controversial.

The regulatory process must be stronger to account for bias. One way to do this would be to ask the White House Council on Environmental Quality (CEQ) to impose environmental targets for each agency and then work with the EPA to ensure agencies are meeting those targets (Jay et al., 2007). While this proposal could face objections, as it might be considered limiting to the work of each agency, it could also make the regulatory job of each individual agency easier by setting clear standards for project approvals. Making the NEPA process less cumbersome might ultimately refocus the work of each agency on the laws' intent.

Public Engagement

Finally, there are questions concerning the effectiveness of NEPA's public engagement efforts. In the case of OIF, the science is so dense that the content of an EA or EIS might not be accessible to the general public. Environmental Assessment and Impact processes have been referred to as an "elitist governance mechanism" due to their emphasis on expertise, and high levels of public participation are considered atypical (Cashmore, Bond, Cobb, 2007). Considering how technical OIF NEPA documents would likely be, there is little chance those engaging the materials would be a representative sample of the US population. This limited representation would only compound the elite, expert-driven nature of the process. The EPA must dedicate itself to simplifying the discussion if they want to meet their NEPA public engagement goals for OIF projects.

The Ocean Dumping Act is Insufficient to Address OIF Regulation

While the EPA believes the Ocean Dumping Act is a suitable tool to regulate ocean fertilization (US GAO, 2010), its use for OIF raises political, jurisdictional, and national security problems.

Jurisdictional Responsibility is Unclear

The LOHAFEX experiment took place on a ship flying the German flag that sailed from South Africa (Jordan, 2009). Due to civil society protests, Germany was forced to bring the ship back to port. Yet, due to the Ocean Dumping Act's limited reach and the lack of US compliance with international enforcement mechanisms, the United States would likely not be able to do the same in similar circumstances. This lack of enforcement could lead to exploitative experimentation by some US entities. In the case of LOHAFEX, the United Nations initially demanded that South Africa bring the ship back to port, but the South African government did not have the ability to carry out such a mission (Jordan, 2009). What does this mean for exploitation of countries with small economies or dysfunctional governments? They could become the launching pad for ocean fertilization experiments.

International Politics of OIF

As ocean fertilization experimentation expands, the US's inability, or unwillingness, to ratify the hallmark pieces of international law related to ocean dumping could pose international political risk. How will the US's role as world leader be affected by our response to issues of ocean fertilization? This is particularly important considering that the Ocean Dumping Act gives US companies the ability to fly another country's flag on their vessel, and leave US territorial waters to perform ocean fertilization experiments without any regulation. US government officials must consider the responsibility the United States bear for such lax regulation.

National Security is a Serious Concern

Ocean dumping could one day be construed as an act of war (Cascio, 2008). As an analogue, the Law of the Sea has codified the notion that each country has an Exclusive Economic Zone or EEZ that extends 200 nautical miles out from their coast (UN, 1983). Countries frequently have disputes over these areas for a number of reasons including overfishing by neighboring countries or access to oil, and some of these disputes have led to aggressive actions including boat ramming and deployment of naval vessels as deterrents (UN, 2010). These EEZ disputes are purely economic, but the international ramifications could be significant if one country or representative of a country dumped iron into the water of another's and the effects of that dump were unclear. Countries might begin to use OIF technologies as a deterrent (Cascio, 2008). How would the US respond if it were being threatened with OIF?

Recommendations to Create a Better Permitting Process

In light of the shortcomings of the current national governance structure, we argue that the permitting and governing process must be expanded to sufficiently regulate OIF. Specifically, we make three recommendations: 1) expand the range of experts and expertise consulted in the current permitting process; 2) require an additional assessment, an International Impact Assessment, to investigate potential international ramifications of any proposed OIF project; and 3) create a public clearinghouse in the form of a website for all permitting documents to ensure transparency and encourage greater public engagement.

Recommendation 1:
Expand the Expertise Consulted in the Permitting Process

The permitting process should incorporate more types of expertise when determining the appropriateness of proposed OIF projects. Specifically, a greater number of experts should be consulted when determining project location, ecosystem-level impacts, and human health concerns. This recommendation rectifies a major shortcoming of the current approach: the lack of an interdisciplinary approach to OIF risk assessment with both the NEPA and ODA permitting processes. To date, OIF projects have been framed as small and local endeavors. This obscures the larger impact they are intended to have. Oceans are complicated systems that impact the global ecosystem. Regulation of OIF experiments must therefore take the scope of these projects into mind, and include expertise currently (and erroneously) considered irrelevant in the permitting process.

a) Project Location

Location is a key factor in the effectiveness of OIF to remove carbon dioxide from the atmosphere. Ocean chemistry and the availability of key nutrients are, in fact, the entire basis of the approach. Without the proper chemicals and nutrients present, OIF will not work for its intended purpose.

There must be discussion with marine scientists and engineers who are experts in ocean biology and ocean currents when discussing project location. These experts can give insight into which location will provide the best success and carbon dioxide sequestration for OIF projects. Stakeholders, such as environmental groups, and federal, state, and local governing bodies with varying expertise must also be included to avoid potential conflicts and resistance due to the choice of location. In addition to the location of potential OIF projects, the migration of the project area and its effects, such as harmful algal blooms, must also be considered. Therefore, oceanographers, ocean modelers, ecologists, and marine biologists should also be included in the discussion, as they can provide information on the potential impacts and the locations to which they may travel. One major problem with discussions about geoengineering science and policy today is the narrow range of consulted expertise. The definition of relevant expertise must be expanded to deal with the complexity of these projects. Including more experts in the NEPA and ODA processes is an effective way to do this.

b) Ecosystem Impact

Ecosystem-level impacts are not traditionally taken into consideration in the permitting process. Typical EIAs only consider the ecology of the area immediately surrounding the OIF zone. This is inherently contradictory, given that one of the main motivations for OIF experiments is to understand the impact of OIF on the local and regional ecosystem. Further, OIF projects by their very nature exist to alter the ecosystem in some way: the ultimate goal of OIF is alter climate, and therefore the *global ecosystem.* Pretending to require minimization of ecological impact while implementing an ecosystem-altering technology necessitates is simply intellectually incoherent.

We recommend expanding the experts consulted in determining ecological impact to allow for evaluation of the ecosystem-level impact of OIF projects. To do this, the NEPA and the ODA must mandate consultation with climate scientists, ocean ecologists, and local oceanographic experts, if the project location is near coastal areas. Such an approach illustrates the importance of an interdisciplinary approach when performing evaluations of OIF projects.

c) Human Health

OIF projects have the potential to dramatically affect the food chain by introducing toxins into the food chain, ultimately impacting human health through consumption (Secretariat of the CBD, 2010; Munro, 2010; Marshall, 2010). This has the potential to cause extreme risk to people dependent on food supplies from areas affected by OIF projects. Despite this risk, the current permitting process does not require an adequate consideration of human health effects. We therefore recommend that permit applications require consultation with toxicologists and epidemiologists to ensure consideration of potential human health impacts.

Recommendation 2:
Require an International Impact Assessment for all OIF Projects

OIF projects require international consultation and decision-making, two things that are not typically included in environmental assessments. The LOHAFEX controversy provides an example of the difficulties that can arise when performing experiments in international waters. However, this can become even more complicated when discussing the potential effects that may migrate to different regions away from the initial location of the OIF project. Further, improperly planned OIF projects could have massive implications for foreign relations, as well as significant national security implications, as previously described.

We recommend creation of an additional assessment, an International Impact Assessment (IIA) that gauges the potential political ramifications of the OIF project under consideration. The report should assess the potential consequences of using the specific proposed location, implications of site migration, and specifically suggest strategies to mitigate potential international relations challenges. The assessment should include the opinion of experts in this field, including international law experts, ocean regulation experts and legal and political experts in those countries most likely to experience the project's impacts. The IIA will provide a holistic view of the international landscape and could mitigate political and national security concerns.

Recommendation 3:
Create a Public Clearinghouse for All Permitting Documents to Ensure Transparency

Government transparency is paramount to ensuring public legitimacy of OIF projects. We therefore recommend creation of an information clearinghouse for all OIF projects funded publicly or privately by groups within the US. As any OIF project over which the US has jurisdiction already has to go through the NEPA and/or ODA processes, centrally locating this information will be easy to achieve. The agency with jurisdictional oversight should create a website where all permit applications, assessments and agency reviews are posted for public viewing. There should also be an opportunity for members of the public to comment on the documents, which could provide a unique opportunity for public engagement in this arena. Increased government transparency is a goal of the Obama administration and one way in which they have worked towards this goal is by establishing a number of government websites. For example, the EPA has an open government website where the public can learn more, ask questions, and provide possible solutions for the current oil spill in the Gulf of Mexico (Environmental Protection Agency, 2010). Given the public outcry surrounding the Deepwater Horizon oil spill in the Gulf of Mexico, concern regarding detrimental effects of industry on the ocean will likely rise in the future. It is reasonable to assume that the public will judge any OIF projects through this same lens, unless there is some process in place, to ensure otherwise.

Conclusion

The current regulatory mechanisms, the National Environmental Protection Act and the Ocean Dumping Act, are insufficient to deal with the unique problems surrounding geoengineering and OIF. International laws and regulations will not help the US in developing a policy to handle OIF, as the United States is both unrestricted and unprotected by those laws. A stronger national system is thus necessary to effectively regulate OIF projects. The recommendations we have made here build on existing regulation provided by NEPA and the Ocean Dumping Act to include the issues of interdisciplinary approaches, transparency and public engagement. However, it is important to note that any regulatory framework built upon

NEPA and ODA may still be inadequate to address OIF regulation. Regardless, OIF regulation is necessary. Clearly, NEPA and ODA in their current form are insufficient to adequately address OIF; however, consideration of the current framework is a reasonable place to begin. These proposals will begin to shape a robust and holistic approach, which is necessary to deal with the intensely complicated field of OIF. As the LOHAFEX experiment made clear, these challenges will only grow and become more complicated over time. It is therefore crucially important that the necessary structure to fully assess OIF projects be put into place now.

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