Policy Response

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# Are Carbon Offsets Appropriate for Ocean Iron Fertilization?

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**RESPONSE to *Science* Policy Forum on January 11, 2008**

Recent data from both natural iron enrichment areas (Blain et al, 2007 and Buesseler et al, 2007) and phytoplankton blooms artificially fertilized with iron (Smetecek et al, submitted) suggest that the efficiency of carbon removal by such blooms can be much larger than previously thought. These results have stimulated new interest in determining whether ocean iron fertilization (OIF) can be an effective technique to mitigate accumulated atmospheric CO2. Twelve public experiments have been conducted over the last 15 years to explore the role of iron in stimulating phytoplankton productivity (Boyd et al., 2007), but the early experiments were not designed to answer questions related to the potential of the technique for sequestering carbon. Over the years, the pages of Science have featured a number of exchanges about both the appropriateness of research into this area, as well as whether claiming carbon reductions from ocean fertilization would be justified (e.g., Chisholm et al, 2001; Johnson and Karl, 2002).

In their Policy Forum "Ocean Fertilization: Moving forward in a sea of uncertainty", (Science, 11 Jan 2008, p 161) Buesseler, et al repeat recent calls (e.g. Boyd et al, 2007) for larger scale OIF experiments. We applaud the general direction of this editorial, which implies the need for further evaluation of the mitigation potential of OIF in the context that the "scientific community has an obligation to assess the ramifications of policy options for reducing greenhouse gas emissions and enhancing CO2 sinks". This is particularly important given the acceleration of CO2 emissions, the decrease in uptake by natural sinks (Canadell et al., 2007), and the greater than previously estimated impacts of CO2 (e.g, on polar environments, ocean acidification, IPCC WG1 and WG2). It is important that the scientific community be prepared to research and evaluate options for decreasing atmospheric CO2 as an addition to the policy measures for reducing emissions that are currently in place (Kyoto Protocol) and contemplated (e.g. US national, regional, and state legislation).

The authors caution that "OIF could make only a partial contribution to mitigation of global CO2 increases" and we agree--there are no "silver bullets" in the fight against climate change. However, even a role which is complimentary to efforts to reduce emissions and develop alternative sources of energy can still be a meaningful part of the overall effort.

The Buesseler, et al (2008) Policy Forum also acknowledges a role for commercial entities, as did a recent symposium on ocean iron fertilization (Holmes, 2008). Both saw the advantage of commercially-funded experiments as long as they are done in partnership with the research community and, if available, in collaboration with funding from government and philanthropic sources.

The authors also remark, however "we are convinced that, as yet, there is no scientific basis for issuing such carbon credits for OIF." They clarify this later: "it is premature to sell carbon offsets from the first generation of commercial-scale OIF experiments unless there is better demonstration that OIF effectively removes CO2, retains that carbon in the oceans for a quantifiable period of time, and has acceptable and predictable environmental impacts."

We agree that a rigorous demonstration of sequestration, permanence, and acceptable environmental effects is essential for the inclusion of OIF in the carbon market. It is industry standard practice to define the measurement approach for these characteristics in a "methodology" document, which is then reviewed by an independent Designated Operating Entity (DOE) both before and after the project initiation. Our company has been working on such a methodology, with significant contributions from Dr. Anthony Michaels at USC, one of the authors of the January 11 *Science* Policy Forum. This draft will certainly evolve over time as the scientific community discusses and investigates the most appropriate measures of carbon sequestration and environmental effects.

Buesseler, et al (2008) state that "we do not understand the intended and unintended biogeochemical and ecological impacts" of OIF as an argument against the sale of offsets. We can understand that this may be an argument for limiting the *extent* to which OIF might be deployed; however, it is not an argument against the early sale of offsets. FutureGen, the proposed coal-fueled, near-zero emissions power plant that will inject carbon into deep geologic sinks is an example of how commercial efforts can move forward as a way to finance the long term monitoring and evolving research important to justifying broader deployment. (NETL/Futuregen) The sale of offsets from forestry projects is also not precluded in spite of the fact that the full atmospheric benefit and ecological impact of such projects is not fully known (Stephens et al, 2007).

The authors state the prerequisite need for "long-term monitoring and use of models to assess downstream effects". We agree. Indeed, the wealth of published biogeochemical modeling certainly suggests that the science of carbon export, air-sea exchange and ocean circulation is well-enough advanced to conservatively quantify stored CO2 from sufficiently instrumented projects. Obviously broader questions of temporal leakage, replenishment of nutrient stocks, and the impact of sustained, long term programs of OIF over decades to centuries are important and need to be resolved before a broader deployment is considered. As the 1992 Rio Declaration "precautionary principle" suggested: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." (Lofstedt, 2003)

We agree many important questions need to be answered, and that the appropriate long term deployment of OIF remains foremost among them. Over the next several years the scientific community will lead OIF projects to determine if measurable sequestration is occurring for meaningful periods of time in a way which is not

harmful to the marine environment. If this can be demonstrated—and verified by qualified third parties—then by definition there is a basis for the sale of carbon offsets from these projects.

We have proposed a Code of Conduct climos.com/standards/codeofconduct.pdf for ocean iron fertilization that proposes adherence to high standards for the conduct of scientific measurements, for the quality of the carbon credits, and for adherence to regulatory requirements.

Private capital seeks a return on investment. To assert that no capital costs should be recovered from the next generation of OIF demonstrations is a demand which is inconsistent with analogous carbon mitigation efforts. To invite the participation of companies which can help fund "commercial-scale" demonstrations while *a priori* precluding the sale of offsets from them is untenable.

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