

The Hawaii Carbon Dioxide Ocean Sequestration Field Experiment:
A Case Study in Public Perceptions and Institutional Effectiveness

by
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Submitted to the Engineering Systems Division and Department of Civil and Environmental
Engineering in Partial Fulfillment of the Requirements for the Degrees of Master of Science in
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Abstract

In December 1997, an international project agreement was signed in Kyoto for a collaborative study of the direct injection of carbon dioxide into the deep ocean. After a detailed international site selection process, the Natural Energy Laboratory of Hawaii Authority (NELHA), a quasi-governmental organization, was chosen as the host for the project in March 1998. In addition to fulfilling the necessary technical criteria, NELHA maintained an ocean research corridor, and it was impressed upon the project team that this could facilitate the permitting process. International steering and technical committees served as advisors to the Hawaii-based project general contractor, Pacific International Center for High Technology Research. The committees also planned a multi-year public outreach program to engage residents of Hawaii about the carbon sequestration project.

Before the outreach program began, a reporter wrote about the planned carbon sequestration experiment in a March 18, 1999 front-page article in the local newspaper, *West Hawaii Today*. As a result, some members of the community started organizing an opposition to the project, culminating in the creation of the “Coalition Against CO₂ Dumping.” Concerns raised by the opposition included the environmental impacts on the ocean ecology, Not-In-My-Backyard feelings, anti-fossil fuel sentiment, and issues regarding native Hawaiian sovereignty. The project team reacted by implementing a dual public relations and outreach strategy, creating a website, responding to hundreds of emails and letters, and holding public meetings. A major fallout from the opposition was that permitting became much more difficult, involving multiple agencies on the state and federal level. In addition, the controversy affected the project’s relationship to its NELHA host and caught the attention of the Hawaii state legislature. After the project team conducted an Environmental Assessment, US Department of Energy issued a Finding of No Significant Impact (FONSI), an important milestone in the permitting process.

This thesis summarizes the events from project start through the issuing of the FONSI, discusses the lessons learned from the experience, and provides recommendations for institutions dealing with public perception issues in future projects.

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Much of the knowledge I gained about the case came from interviews of those intimately involved. For their time and insight, I would like to thank Eric Adams, Perry Bergman, Bob Kane, Judy Kildow, Lloyd Lorenzi, Steve Masutani, Gerard Nihous, Jeff Summers, David Tarnas, and Rob Wilder.

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Acronyms

DOE	U.S. Department of Energy
EA	Environmental Assessment
EIS	Environmental Impact Statement
FONSI	Finding Of No Significant Impact
NEDO	Japan New Energy and Industrial Technology Development Organization
NELHA	Natural Energy Laboratory of Hawaii Authority
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory of U.S. Department of Energy
NRC	Norwegian Research Council
PICHTR	Pacific International Center for High Technology Research

TIMELINE

June 1997	Scoping study identifies potential sites
December 4, 1997	Project agreement signed in Kyoto
December 1997 – January 1998	Comprehensive evaluations of prospective sites
March 1998	Hawaii selected as experimental site
March 18, 1999	Experiment first made public in local newspaper, <i>West Hawaii Today</i>
September 22, 1999	Application to conduct experiment submitted to NELHA
October 19, 1999	Project application approved by NELHA Board of Directors
August 2000	Draft environmental assessment released by DOE
February 20, 2001	NELHA withdraws support for project
April 2001	Final environmental assessment released by DOE
April 25, 2001	Hawaii House Concurrent Resolution 64 (HCR64) approved by state legislature
May 4, 2001	Finding of No Significant Impact by DOE

INTRODUCTION

“Scientists at the Pacific International Center for High Technology Research, collaborating with an international team, are planning to inject liquefied carbon dioxide at a depth of about 900 metres off the Kona coast. The experiment, proposed for the Natural Energy Laboratory of Hawaii, would be conducted in 2001 in an established research corridor in the ocean. It is designed to gather the environmental data to properly assess future sequestration experiments. The authority that governs the Natural Energy Laboratory has yet to approve the experiment. But some environmental groups fear that it will harm the ocean ecosystem and give encouragement to the construction of another power plant. Scientists fear that the entire experiment may be jeopardized by delays. If the opportunity to conduct a reasoned environmental-assessment experiment disappears, both environment and science will be the losers.”

- *Editorial in Nature, September 23, 1999*

The objective of this thesis is to provide a case history and policy analysis of the international ocean carbon sequestration field experiment proposed in Kona, Hawaii. Scientists and engineers from six countries and four continents designed a study to look at the effect of injecting 20-40 tonnes of carbon dioxide into ocean waters off the Kona coast.¹ Once the experiment became public, several Kona residents mounted an intense two-year opposition campaign against the project, eventually forcing the project to move out of the Kona region. From the standpoint of the scientists, they were trying to conduct a scientific experiment; from the standpoint of the project sponsors, the experiment showed a commitment to the environment; from the standpoint of the opposition, residents were trying to protect their community and personal interests.

¹ E. Adams, M. Akai, L. Golman, P. Haugan, H. Herzog, S. Masuda, S. Masutani, T. Ohsumi and C.S. Wong, “An International Experiment on CO₂ Ocean Sequestration,” presented at the *Fourth International Conference on Greenhouse Gas Control Technologies*, Interlaken (Switzerland), 1998.

I examine the Kona experiment through the lens of a policy analyst. In Part I of the thesis, I set up the situation, introducing the technical and policy concepts important to the case. This includes a summary of the “state of the science” in carbon sequestration, and an overview of the events leading up to the project opposition in Hawaii. In Part II, I present the arguments of the key players in the case and show how their points of view differ according to stakeholder category. In Part III, I take a detailed look at three major battles that pitted the key players in the case against each other. In Part IV, I perform a policy analysis by bringing the case history, frames of reference, and battles together, presenting important take away points. In Part V, I summarize the events that have transpired post-Kona, and follow that with some concluding remarks concerning the implications of public perceptions and institutional effectiveness to further research in carbon sequestration—and technology, in general.

Dr. Gerard Nihous (Pacific International Center for High Technology Research) and Mr. Howard Herzog (Massachusetts Institute of Technology) provided me access to articles in the local Hawaii media about the experiment; a record of these articles has been compiled in the appendix of the thesis. I also conducted a background literature survey about the technology underlying the experiment. The project team provided me access to internal emails and documents that provided insight into the decision-making process. I was also given access to emails and letters sent to the project team from outside the project, and the project team’s responses to them. Finally, I conducted in-person and telephone interviews of relevant stakeholders in the experiment, including: Dr. Eric Adams (Massachusetts Institute of Technology), Dr. Perry Bergman (U.S. Department of Energy), Mr. Herzog, Mr. Robert Kane (U.S. Department of Energy), Dr.

Judith Kildow (University of Southern California; formerly of Massachusetts Institute of Technology), Mr. Lloyd Lorenzi (U.S. Department of Energy), Dr. Stephen Masutani (University of Hawaii), Dr. Nihous, Mr. David Tarnas (Marine and Coastal Solutions International), and Dr. Robert Wilder (Hydrogen Fuel Cell Institute; formerly of the Pacific Whale Foundation and a key member of the opposition). Although I tried getting in touch with more members of the opposition, my letters were returned to sender and my emails received no response.

PART I: DEFINING THE ISSUES

1. Motivations for an Ocean Carbon Sequestration Experiment

“A much larger science-based CO₂ sequestration program should be developed. The aim should be to provide a science-based assessment of the prospects and costs of CO₂ sequestration. This is very high-risk, long-term R&D that will not be undertaken by industry alone without strong incentives or regulations, although industry experience and capabilities will be very useful.”

– *President’s Council of Advisors on Science and Technology in Report to the President on Federal Energy Research and Development for the Challenges of the Twenty-First Century, November 1997*

It has been said that the biggest problem for energy is the environment and the biggest problem for the environment is energy. Why does this tradeoff exist? What has society done to remedy the situation? In this chapter, I aim to answer these questions. In particular, I will introduce the concept of “carbon sequestration” and present some of the reasons why its application has become such a contentious issue.

Throughout our world—from the fuel that powers our cars to the electricity that powers our homes—we rely on fossil fuels as our primary source of energy. Fossil fuels are made up of carbon-based molecules. When burned, one of their main by-products is carbon dioxide. Over a hundred years ago, the Swedish chemist Svante Arrhenius studied how carbon dioxide might affect our climate. Arrhenius, upon seeing an increasing amount of carbon dioxide being released into the atmosphere, predicted that if atmospheric carbon dioxide doubled, the Earth would become several degrees warmer.² Arrhenius’s prediction has come to be known as the “greenhouse effect.” The greenhouse effect is caused by the presence in the atmosphere of greenhouse gases, such

² National Aeronautics and Space Administration, “Global Warming,” *The Earth Science Enterprise Series*, Report No. NF-222 (April 1998): 1-4.

as carbon dioxide, that trap some of the infrared energy radiated from the Earth and prevent it from escaping into outer space.³ According to the U.S. Energy Information Administration, U.S. carbon dioxide emissions in 2000 totaled 1,583 million metric tons carbon equivalent, about 83 percent of total U.S. greenhouse gas emissions and about 25 percent of total world carbon dioxide emissions.⁴

Recent evidence appears to show that the climate is changing, especially in the last fifty years. The average temperature of the Earth has increased 0.6°C over the 20th century.⁵ It has been reported that the 1990s was the warmest decade, and 1998 the warmest year in the instrumental record.⁶ Although some have argued that the warming climate may not necessarily be a result of fossil fuel use, most climate change models have concluded that the estimated rate and magnitude of warming due to increasing concentrations of greenhouse gases (e.g. carbon dioxide) are comparable with the observed warming.⁷

Do governments have a responsibility to tackle climate change? According to a view known as the “precautionary principle,” governments should take a precautionary stance against climate change—to take actions before there is conclusive scientific

³ H. Jacoby, R. Prinn, and R. Schmalensee, “Kyoto’s Unfinished Business,” *Foreign Affairs* 77 (1998): 54-66.

⁴ Energy Information Administration, “Carbon Dioxide Emissions,” *Emissions of Greenhouse Gases in the United States 2000*, Report No. DOE/EIA-0573(2000) (November 2001): 19, and Energy Information Administration [Internet], Washington (DC): Table H1 World Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels, 1991-2000; [updated April 24, 2002; cited May 8, 2002]. Available from: <http://www.eia.doe.gov/emeu/iea/tableh1.html>.

⁵ Intergovernmental Panel on Climate Change [Internet], Geneva (Switzerland): *Summary for Policymakers – A Report of Working Group I of the Intergovernmental Panel on Climate Change*; [updated January 20, 2002; cited May 8, 2002]. Available from: <http://www.ipcc.ch/pub/spm22-01.pdf>.

⁶ Ibid.

⁷ Ibid.

evidence that harm is occurring.⁸ From an energy systems view, there are several options governments can pursue to mitigate climate change.

One option is to pursue energy conservation and energy efficiency. Energy conservation means using less energy. An example is encouraging households to turn off lights when leaving a room. Energy efficiency involves improving or replacing an existing technology so that it uses less energy. An example is replacing an incandescent light bulb with a fluorescent light bulb. Whether one is pursuing conservation or efficiency, the goal is to reduce the load on the overall energy system. If a society uses less energy, its reliance on fossil fuels will decrease, and (presumably) less carbon dioxide will be released into the atmosphere.

A second option is to pursue non-carbon energy sources. Some of these technologies have become known as “renewable” because of their long lifetimes; they are derived from sources that are not exhausted on the same time scales as fossil fuels. In their energy restructuring plans, some states have called for a certain proportion of their energy portfolio to come from renewables, a so-called “renewable portfolio standard.” Nuclear and hydropower fall under the category of non-carbon energy source, although many in the energy community would not classify them as “green” because of other considerations.⁹

⁸ The precautionary principle originated in West Germany in the 1970s as “vorsorgeprinzip” or “foresight planning” for its environmental policy. For more information, see: K. von Moltke, “The Vorsorgeprinzip in West German Environmental Policy,” in Royal Commission on Environmental Pollution, ed., *Best Practicable Environmental Option* (London, United Kingdom: Royal Commission on Environmental Pollution, 1988), pp. 57-70.

⁹ M. de Figueiredo, “Integrating Green Energy and Energy Efficiency: a Viable Option for New England’s Competitive Electricity Markets?” in Massachusetts Institute of Technology Energy Laboratory [Internet]. Cambridge (MA): Sustainable Energy Proceedings; [cited May 8, 2002], Available from: <http://web.mit.edu/energylab/www/se/proceedings.html>.

Some in the energy community have called for a third option—managing the carbon of fossil fuels. Carbon management can take several forms.¹⁰ In its *terrestrial* form, CO₂ is removed from the atmosphere by enhancing uptake in soils and vegetation. *Geologic* sequestration involves injecting CO₂ into the ground and storing it in geologic formations (such as deep saline aquifers, depleted oil and gas reservoirs, and coal seams).

In this thesis, I will be focusing on *ocean* carbon sequestration, or using the ocean as a reservoir for carbon dioxide. According to the Lawrence Berkeley National Laboratory, the ocean takes up about a third of the carbon currently emitted by fossil fuel activity annually, or roughly two billion metric tons each year.¹¹ The concept of using technology to increase the amount of carbon dioxide taken up by the ocean dates back to at least 1977, when Cesare Marchetti of the International Institute for Applied Systems Analysis (IIASA) proposed collecting carbon dioxide from power plants and injecting it into deep ocean waters.¹²

There are two major ocean carbon sequestration options: ocean fertilization and direct injection. The two are fundamentally different processes. Ocean fertilization seeks to enhance the oceanic uptake of atmospheric carbon dioxide by adding micronutrients such as iron to the ocean, or perhaps even macronutrients such as nitrates and phosphates.¹³ This encourages photosynthetic organisms called phytoplankton to convert

¹⁰ For more information about carbon management, see: H. Herzog, “What Future for Carbon Capture and Sequestration?” *Environmental Science and Technology* 35 (April 2001): 148A-153A and H. Herzog, B. Eliasson and O. Kaarstad, “Capturing Greenhouse Gases,” *Scientific American* 282 (February 2000): 72-79.

¹¹ U.S. Department of Energy Center for Research on Ocean Carbon Sequestration [Internet], Berkeley (CA): *Background on the Ocean Carbon Cycle and Sequestration*; [cited March 11, 2002]. Available from: <http://www-esd.lbl.gov/DOCS/index2.html>.

¹² C. Marchetti, “On Geoengineering and the CO₂ Problem,” *Climatic Change* 1 (1977): 59-68.

¹³ For more information on ocean fertilization, see S. Chisholm, “Dis-Crediting Ocean Fertilization,” *Science* 294 (2001): 309-310 and S. Chisholm, “The Iron Hypothesis: Basic Research Meets Environmental Policy,” *Reviews of Geophysics* 33 (1995): 1277-1286.

carbon dioxide to organic carbon. Direct injection, on the other hand, requires a relatively pure carbon dioxide stream, generally obtained from coal or gas-fired power plants (near a coast). The carbon dioxide is then directly injected using the deep ocean as a reservoir. The pros and cons of ocean fertilization and direct injection are listed in Figure 1.

The biggest advantage of direct injection is that it is technically feasible. A notable disadvantage for direct injection, however, is the cost of capturing carbon dioxide directly from power plants. This thesis focuses on a proposed experiment in Hawaii studying direct injection.

Figure 1: Comparison of Ocean Carbon Sequestration Methods

	Ocean Fertilization	Direct Injection
Pros	<p>Relatively inexpensive</p> <p>Simple technologically</p> <p>May improve fishery yields</p>	<p>Effective at sequestering carbon</p> <p>Based on proven technologies</p> <p>Strategies can be developed (e.g. carbonate dissolution) to enhance effectiveness and diminish adverse environmental consequences</p>
Cons	<p>Effectiveness not proven</p> <p>Possible environmental consequences (e.g. ecosystem disturbance)</p>	<p>Consumes energy, expensive</p> <p>Suitable only for point sources with access to ocean waters</p> <p>Possible environmental consequences (e.g. pH effects)</p>

Source: H. Herzog, "Ocean Carbon Sequestration," *Workshop on Carbon Sequestration Science*, Cambridge: Massachusetts Institute of Technology, 2001.

2. The Road to Controversy

“We have many technological tools to address pollution and climate concerns. But to achieve our ultimate goal of stabilizing atmospheric concentrations of greenhouse gases, we must also look to long-range concepts that can sequester or reuse carbon from industrial processes and fuel combustion gases. We want to look beyond what is currently feasible with today's technology.”

- *U.S. Energy Secretary Federico Peña on the international ocean sequestration project, December 1997*¹⁴

2.1 A Project Agreement Is Signed

The U.S. Department of Energy (DOE), the New Energy and Industrial Technology Development Organization of Japan (NEDO) and the Norwegian Research Council (NRC) are major governmental energy and research bodies in their respective countries.¹⁵ The organizations felt that ocean carbon sequestration via direct injection should be investigated as a mitigation option for global climate change. The governmental bodies agreed to an initial field experiment, with the hope that if the initial experiment was successful, there would be two subsequent field evaluations of increasingly larger scale to evaluate environmental impacts of sequestration and the potential for commercialization.¹⁶

On December 4, 1997, DOE's National Energy Technology Laboratory (NETL), NEDO, and NRC entered into a contract, now known as the *Project Agreement for*

¹⁴ U.S. Department of Energy [Internet], Washington (DC): *U.S., Japan, Norway Sign First Kyoto Agreement*;

Will Jointly Sponsor Tests for Long-Term CO₂ Disposal; [updated December 4, 1997; cited April 22, 2002]. Available from: http://www.fe.doe.gov/techline/tl_co2seq.html.

¹⁵ The DOE Federal Energy Technology Center (FETC) signed the agreement on behalf of DOE. After a re-organization, FETC became the National Energy Technology Laboratory (NETL).

¹⁶ See Adams et al., Note 1.

International Collaboration on CO₂ Ocean Sequestration, a copy of which can be found in the appendix of this thesis. The groups signed the agreement in Kyoto, Japan, during the Third Conference of Parties (COP-3) to the United Nations Framework Convention on Climate Change (UNFCCC) where the Kyoto Protocol was developed. From the view of the governments, they wanted international publicity—it showed their commitment to mitigating global climate change. By signing the agreement in Kyoto, however, the project opened itself to international scrutiny. In retrospect, members of the scientific community may not have wanted the experiment to become such a public spectacle.

DOE, NEDO and NRC have come to be known as the original “sponsors” of the project. They were later joined by organizations from Japan, Australia and Canada and a Swiss/Swedish engineering firm. They created a Steering Committee to manage the direction of the project and a Technical Committee to guide the scientific aspects of the experiment. The Steering Committee was made up of representatives from the sponsor organizations; the Technical Committee included universities and research organizations from the sponsor countries. Figures 2 and 3 show the compositions of the Steering Committee and Technical Committee, respectively.

*Figure 2: Steering Committee*¹⁷

- Asea Brown Boverly Corporate Research (ABB) – Switzerland/Sweden
- Central Research Institute of the Electric Power Industry (CRIEPI) – Japan
- Commonwealth Scientific and Industrial Research Organization (CSIRO) – Australia
- Department of Energy (DOE) – United States*
- Natural Resources Canada (NRC) – Canada
- New Energy and Industrial Technology Development Organization (NEDO) – Japan*
- Norwegian Research Council (NRC) – Norway*

*Figure 3: Technical Committee*¹⁸

- Central Research Institute of Electric Power Industry (CRIEPI) – Japan
- Commonwealth Scientific and Industrial Research Organization (CSIRO) – Australia
- Hawaii Pacific University (HPU) – United States
- Institute of Ocean Sciences (IOS) – Canada
- Kyoto University (KU) – Japan
- Massachusetts Institute of Technology (MIT) – United States*
- Nansen Environmental and Remote Sensing Center (NERSC) – Norway
- National Institute of Advanced Industrial Science and Technology (AIST) – Japan*
- Norwegian Institute for Water Research (NIVA) – Norway*
- Pacific International Center for High Technology Research (PICHTR) – United States
- Research Institute of Innovative Technology for the Earth (RITE) – Japan*
- University of Bergen (UOB) – Norway*
- University of Hawaii (UH) – United States*

¹⁷ Asterisk (*) denotes Steering Committee member was an original sponsor of the experiment.

¹⁸ Asterisk (*) denotes Technical Committee member was an original member of the experiment.

Figure 4: Funding of the Project¹⁹

Initial Project Budget: \$3.8 million Japan (68.4%), US (22.4%), Norway (9.2%)
2001 Project Budget: \$4.6 million ²⁰ Japan (68.5%), US (20.9%), Norway (7.1%), Others (3.5%)

2.2 Goals of the Field Experiment

The Steering and Technical Committees called for the first experiment to validate computer models on the behavior of liquid carbon dioxide released in the deep ocean at a depth of about 800 – 1000 meters. The Technical Committee developed four specific objectives for the experiment:

- (1) Investigate carbon dioxide droplet plume dynamics through qualitative and quantitative methods;
- (2) Clarify the effects of hydrates on the dissolution of carbon dioxide droplets through qualitative and quantitative methods;
- (3) Trace the evolution of the carbon dioxide-enriched seawater by performing three-dimensional mapping of velocity and acidity; and
- (4) Assess the biological effect, with special emphasis on bacterial biomass, production, and growth efficiency due to changes in seawater acidity.

¹⁹ The distribution does not include in-kind contributions by the sponsors, which are of an order similar to the project budget itself.

²⁰ This budget figure includes the money that was spent on the field experiment prior to 2001. A large component of the increased budget was to perform a formal environmental assessment not originally anticipated by the project team.

Prior to the project agreement, several models had been developed to estimate the effectiveness of injecting carbon dioxide in the ocean. While they offered a prediction of behavior, scientists still did not completely understand the fundamental physics of the direct injection process because of problems replicating ocean conditions.²¹ For this experiment, the Technical Committee surmised that the carbon dioxide droplets would rise a certain distance (about 100 meters) before being dissolved. Acidity in the area surrounding the release point would increase, and as the plume of dissolved carbon dioxide diffused into the ocean, it would be diluted and the acidity would return to normal levels.

The Technical Committee proposed several methods for injecting the carbon dioxide into the ocean. These included injection from: (1) a vertical pipe attached to an oil platform; (2) a submerged tank; (3) a flexible pipe tethered to a moving ship; and (4) a pipe installed along the ocean floor. The Technical Committee decided to pursue the last option. Because some of the other options had not been used in other analogous field experiments, they would be more difficult in terms of technology. The Technical Committee also thought the option would minimize cost because the carbon dioxide would be handled on shore and any problems with the delivery systems could be dealt with before the start of the experiment.

²¹ Caldeira, K., H. Herzog, M. Wickett. 2001. Predicting and Evaluating Effectiveness of Ocean Carbon Sequestration by Direct Injection. *First National Conference on Carbon Sequestration*. Washington, DC: U.S. Department of Energy.

2.3 Selection of a Field Experiment Site

With the experimental objectives and methods in mind, a subset of the Technical Committee conducted a study to scope potential locations for the field experiment. Several locations were considered, including Norway, Bermuda, Hawaii, and the Gulf of Mexico. The “Scoping Committee” narrowed the decision to Bermuda and Hawaii, calling for an in-depth analysis of those locations. These locations were chosen because of past ocean research experiences, the possibility of deep water close to shore, and predictability of weather.

Comprehensive technical site evaluations were conducted in Bermuda and Hawaii in December 1997 and January 1998 respectively. Several criteria were used to evaluate the sites. First, the site needed to be close to deep water in order to minimize the cost of CO₂ transportation from shore. Second, the temperature and density gradients needed to be representative of a site where carbon sequestration would be conducted in the future. Third, the site needed to have sufficient infrastructure to house/support the project, such as trained personnel and the ability to handle CO₂ tanks. Fourth, there needed to be a straightforward process for obtaining project permits.

Both Bermuda and Hawaii fulfilled the experiment’s initial technical criteria, but the Technical Committee thought that Hawaii would be a better experiment location for scientific reasons. Hawaii had been a site for previous Ocean Thermal Energy Conversion (OTEC) experiments.²² Several members of the committee had been involved in the OTEC research, meaning that they were familiar with the oceanographic data that existed and less data collection would be needed for the sequestration

²² For more information on OTEC in Hawaii, see: Hawaii Department of Business, Economic Development and Tourism [Internet]. Kona (HI): *Ocean Thermal Energy Conversion*; [updated July 25, 2002; cited May 8, 2002]. Available from: http://www.hawaii.gov/dbedt/ert/otec_hi.html.

experiments.²³ The Technical Committee was impressed with Hawaii's technical capabilities; the University of Hawaii, for example, had a strong marine research program. In addition, the Technical Committee felt that the Pacific International Center for High Technology Research (PICHTR), a spin-off of the University of Hawaii with experience in coordinating research projects, could serve as general contractor for the project.

Probably the most crucial reason, however, was permitting. The Natural Energy Laboratory of Hawaii Authority (NELHA), a quasi-governmental research institution, operated a designated "ocean research corridor" at Keahole Point on the big island of Hawaii near the town of Kona. The corridor was the host of several technical projects in the past, and the Technical Committee thought that operating in a designated research corridor would make permitting easier than in other locations. During the site selection study, NELHA was able to obtain a compliance certification permit from the US Army Corps of Engineers for the project within a matter of weeks.²⁴

There were some disadvantages to locating the experiment at NELHA's Keahole site. In retrospect, the project scientists and sponsors feel that NELHA was not as forthcoming about these drawbacks. Adjacent to the NELHA site is the Hawaii Island Humpback Whale National Marine Sanctuary, where an estimated two-thirds of the North Pacific humpback whale population migrate to breed.²⁵ Coral reefs exist on the shallow-water seafloor; there would be technical challenges to lay down a carbon dioxide

²³ E. Adams, personal communication (October 5, 2001), Senior Research Engineer, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Room 48-325, 77 Massachusetts Avenue, Cambridge, MA 02139, Tel 617-253-6295, Email eadams@mit.edu.

²⁴ A copy of this permit can be found in Appendix E.

²⁵ National Oceanic and Atmospheric Administration [Internet], Silver Spring (MD): *Hawaiian Islands Humpback Whale*; [updated May 5, 2002; cited May 8, 2002]. Available from: <http://www.sanctuaries.nos.noaa.gov/oms/omshawaii/omshawaii.html>.

pipe that would not disturb the reefs. Finally, NELHA has a history of disputes with its neighbors, examples of which will be discussed in the next section. While the project team was aware of the drawbacks, they feel that the degree to which they could potentially impact the experiment was under-emphasized.

Figure 5: Natural Energy Laboratory of Hawaii Authority (NELHA)

In 1974, the Hawaii State Legislature established NELHA as an independent, non-profit corporation. NELHA's stated mission to facilitate the research, development and commercialization of natural energy resources and ocean-related research, technology and industry in Hawaii.²⁶ NELHA, located on the Big Island of Hawaii at Keahole Point, holds several federal, state and county permits, making it a lucrative location for prospective projects. These permits include: (1) Special Management Area Use Permits, required from the county for all activities in the coastal zone; (2) Conservation District Use Permits from the Hawaii Department of Land and Natural Resources for all activities on conservation land, including a permitted offshore research corridor that extends 10,000 feet offshore; (3) Water Quality and National Pollutant Discharge Elimination System (NPDES) permits from the U.S. Environmental Protection Agency through the Hawaii Department of Health; and (4) Coastal Zone Construction Permits from the U.S. Army Corps of Engineers.²⁷ NELHA's location is below the Underwater Injection Control (UIC) line, giving it an exemption from regulations that limit injection into groundwater.²⁸

²⁶ National Energy Laboratory of Hawaii Authority. *Commercial Development to Support Ocean-Related Activities at NELHA*. Solicitation No. RFP-02-12-NELHA (2002).

²⁷ T. Daniel, "The National Energy Laboratory of Hawaii Authority: A State-Sponsored Aquaculture and Research Park (I)," *IOA Newsletter* 10 [Internet], Spring 1999, [cited April 22, 2002]. Available from: <http://ioa.erl.itri.org.tw/vol10-1.htm>.

²⁸ *Ibid.*

Figure 6: Pacific International Center for High Technology Research (PICHTR)

The Hawaii State Legislature established PICHTR in 1983 as an independent non-profit corporation to “advance a thriving, economically secure, and environmentally conscious future for Hawaii and the Asia-Pacific region.”²⁹ PICHTR’s stated mission is to facilitate the sustainable development practices and work in the region on the planning, development, evaluation and deployment of renewable technologies. PICHTR provides engineering and project management for renewable energy demonstration projects, technical assistance in ocean engineering and science, education and technical training, and administrative services.

2.4 Examples of Controversies at Keahole Point

OTEC

Ocean thermal energy conversion (also known as OTEC) converts solar radiation to electric power. In areas such as Hawaii, the water at the surface of the ocean is much warmer than the water at the bottom of the ocean. The temperature difference can be used to generate electricity via heat exchangers and an appropriate working fluid.

In the summer of 1987, an OTEC project was planned for NELHA’s Keahole Point facility. A large trench was blasted for the installation of a 40-inch cold water pipe and a 24-inch warm water pipe that would deliver seawater from the ocean to NELHA’s onshore Keahole Point facility. The results of the explosions have proven harmful to the marine life at Keahole. It was originally thought that only two pipes would be placed in the trench and the open area would be filled with the volcanic basalt that was blasted, however, three or four more pipes were placed in the trench—as many pipes as the trench would fit—and the dredged material was left behind on the seafloor and capped with a

²⁹ Pacific International Center for High Technology Research [Internet], Honolulu (HI): *What is PICHTR?* [cited May 8, 2002]. Available from: <http://www.pichtr.org/>.

layer of concrete. In 1989, the National Marine Fisheries Service registered a complaint that the concrete cap was both flaking and eroding as fine particulate material. A University of Hawaii report, also from 1989, concluded that coral species had declined by 44% and coral cover had declined by 65%.³⁰ The report estimated that the area of impact would require twenty years to attain pre-construction status. NELHA cleaned up the seafloor in the summer of 1990.³¹

Chemical Spill

Sometime between April 1, 1997 and March 2, 1999, a refrigerant spill took place in the waters at NELHA's Keahole Point facility.³² The chemical in question was dichlorofluoroethane, also known as R141b. The spill was traced back to an experimental desalination plant operated by a Keahole Point tenant, Thermal Energy Storage, Inc. (TESI). TESI used the refrigerant to convert the seawater to a salt-free hydrate. This hydrate was then melted and the R141b extracted, leaving fresh water. The project ran from September 1995 to May 1998, at which point the researchers ran out of money. TESI left the site, leaving several hundred gallons of the R141b unattended in a seven-foot-high plastic container.

³⁰ P. Tummons, "Trench at Keahole Point Takes Toll on Marine Life," *Environment Hawaii* 1 [Internet], May 1991 [cited April 22, 2002]. Available from: <http://www.planet-hawaii.com/environment/591cov.htm>.

³¹ E. Bender, "Oceans of Power," *Technology Review* [Internet], August 13, 2001 [cited April 22, 2002]. Available from: <http://www.techreview.com/articles/bender081301.asp>.

³² Star-Bulletin Staff, "State Looks Into Deadly Kona Chemical Spill," *Hawaii Star-Bulletin*. [Internet]; September 21, 1998 (cited April 22, 2002), Available from: <http://starbulletin.com/98/09/21/news/briefs.html>; B. Command, "NELHA Slapped with \$17.7M State Fine," *West Hawaii Today* [Internet]; May 3, 2001 (cited April 22, 2002), Available from: <http://www.westhawaii.com/daily/2001/May-03-Thu-2001/news/news3.html>; Envirowatch [Internet], Mililani (HI): *Fishermen and Other Members of the Public Exposed to Toxic Chemical at Keahole Point, Kona, Hawaii*; [cited April 22, 2002], Available from: <http://www.envirowatch.org/toxic.htm>.

A native Hawaiian family fishing in the area discovered the spill on September 13, 1998; they saw dead fish in tidal pools and experienced skin irritation. The family reported the case to the Hawaii Department of Land and Natural Resources, who in turn handed it over to the Hawaii Department of Health. NELHA contended that R141b has a low toxicity and most likely killed the fish by depriving them of oxygen, not by poisoning them, thus there would be no effect in humans.

2.5 Initial Policy Evaluation of Hawaii by Kildow

The Steering Committee was very interested in maintaining a high profile for the field experiment and asked the Technical Committee to assess Hawaii's political feasibility. In December 1997, the project recruited Dr. Judith Kildow, a leading researcher in the political economy and public policy of marine science, to conduct an in-depth evaluation of Hawaii, and possibly coordinate a strategy for engaging the public.³³ Dr. Kildow interviewed project team members, scientists, regulators, environmentalists, and legislators in Hawaii. She focused on four issues during the course of her evaluation: (1) the dynamics of local and state-wide politics that might affect a scientific project at NELHA, including areas of strong support, adversaries and key stakeholders; (2) previous or current controversies and successes that have occurred in Hawaii, including marine-based cases and environmental issues; (3) local perceptions of marine science,

³³ Dr. Judith Kildow is currently Senior Research Scientist at the University of Southern California's Wrigley Institute for Environmental Studies and Principal Investigator of the National Ocean Economics Project. At the time of the sequestration project, Dr. Kildow was Associate Professor of Ocean Policy at the Massachusetts Institute of Technology (MIT) and Head of the MIT Program in Marine Environmental Systems.

scientists, and science in general; and (4) scientists' impressions of interacting with the local community on the project.

Dr. Kildow concluded that PICHTR and NELHA were mostly business oriented and under strong pressures to produce revenue and jobs; the sequestration experiment, on the other hand, was research oriented and not a revenue generator for the economy. She felt that local and state-wide interests were strong, particularly with regard to religious, cultural, and environmental interests. Dr. Kildow advocated nurturing relationships with individuals and local community members, delivering messages directly to those who may either be affected by the project or perceive they would be affected. She recommended a gradual outreach program that would build a constituency and enable local citizens to participate in the design and progress of the project.

Upon reviewing the technical and policy analyses, the Technical Committee recommended to the Steering Committee that the carbon sequestration experiment be sited in Hawaii, with PICHTR serving as the project's general contractor. This decision was subsequently approved by the project Steering Committee.

Figure 7: Individuals Interviewed During Kildow's Site Evaluation of Hawaii

Jacquie W. S. Brewbaker <i>Program Manager for Outreach and Administration, National Defense Center of Excellence for Research in Ocean Sciences</i>	Stephen Masutani, Ph.D. <i>Researcher, Hawaii Natural Energy Institute, University of Hawaii</i>
John Craven, Ph.D. <i>Consultant, Natural Energy Laboratory of Hawaii Authority; Adjunct Professor, University of Hawaii</i>	Jackie Miller, Ph.D. <i>Co-Director, Environmental Center, University of Hawaii</i>
Thomas H. Daniel, Ph.D. <i>Technical Director, Natural Energy Laboratory of Hawaii Authority</i>	Janelle K. Saneishi <i>Account Coordinator, Lynette Lo Tom Communications</i>
James Frazier <i>Executive Director, Natural Energy Laboratory of Hawaii Authority</i>	Carolyn Stewart <i>Coordinator, Hawaii Coastal Zone Management</i>
John Harrison, Ph.D. <i>Co-Director, Environmental Center, University of Hawaii</i>	David Tarnas <i>House Representative, 6th District, Hawaii State Legislature</i>
Maurice H. Kaya <i>Administrator for Energy, Resources and Technology Division, Hawaii Department of Business, Economic Development and Tourism</i>	Lynette Lo Tom <i>President, Lynette Lo Tom Communications</i>
Barbara Lee <i>Marketing Specialist, Natural Energy Laboratory of Hawaii Authority</i>	Tom Tsurutani <i>President and CEO, Pacific International Center for High Technology Research</i>
Alexander Malahoff, Ph.D. <i>Director of Hawaii Underwater Research Laboratory and Professor of Oceanography, University of Hawaii</i>	

2.6 A Planned Public Outreach Strategy

Subsequent to the decision to site the project at Hawaii, Dr. Kildow developed a public outreach strategy for the field experiment and submitted it for consideration to the Steering Committee. Public outreach would be pursued from two perspectives. The first would be short-term, specific to the Hawaii project, and would have a local focus. The second would be a long-term perspective, and global in scope. Dr. Kildow felt that science should receive the same public scrutiny as other non-science activities, and that scientists must work with the public to educate, inform, and eventually persuade the public of the importance and nature of the experiments in question. She recognized that any act that might be perceived to cause harm to the environment would receive criticism and that reaching out to the public with clear and accurate information could be a tricky process, but information could also mitigate risk.

With regard to the Hawaii experiment, Dr. Kildow recommended a strategy to be implemented in six stages over four years, commencing even before the experiment was to begin. The public outreach plan had several goals. Scientists involved with the project would secure the trust of the public and build understanding as to the importance of the project. The project would work with environmental groups and local stakeholders to make sure that their concerns were heard. Finally, members of the project would identify sources of opposition early in the project in order to incorporate concerns into the experimental protocols. Dr. Kildow recommended several different methods of approach, including gathering data on past projects that attracted public opposition, identifying audiences to be informed, working with scientists and the research team to

develop information packages, and selecting members of the community to serve as an oversight group to the project.

The first phase of the public outreach plan was information gathering, and would run from April 1, 1998 – June 30, 1998. It was meant to gradually develop a local constituency of interested parties. Information would be compiled about the project and pertinent local groups. A database of key individuals and groups with an interest in this type of project would be kept, and meetings would be scheduled with these groups. Data would be collected on past ocean research experiments, so that the project could build on the relevant experience.

The second phase was strategy building and initial implementation of the outreach plan, running from July 1, 1998 – September 30, 1998. One-on-one meetings with local authorities and group leaders would be conducted, and brochures and newsletters would be developed explaining carbon sequestration and global climate change research.

The third phase was full implementation of public outreach over a six- month period from October 1, 1998 – March 30, 1999. During this time period, a community advisory group would be formed consisting mostly of non-governmental individuals. Scientists would be selected to interact with local groups, and members of the media would be contacted on a low-key, background basis. A website would be developed about the project, and the legal and political environment would be monitored for changes.

The fourth phase, between April 1, 1999 and March 30, 2000 would continue the implementation of public outreach, and summarize the activities to create a list of “lessons learned” to facilitate public outreach for the next experimental project. Relevant

constituencies would remain in communication with the project, and interest groups with a stake in the project's outcome would also be informed. Brochures and newsletters would again be sent out to provide information to the public. The website developed in the third phase of public outreach would be placed online and updated regularly. In addition, a website would be developed to provide live video feeds, or taped video if that is not possible, for use during the experiment. Documentation for the experiment would be arranged, including video, photography, and scientific reporting.

The fifth phase of the project, from April 1, 2000 – September 30, 2000, would be the experimental phase of the project. Local efforts would be intensified, and all constituencies would be revisited on a personal basis, and national media would be invited to the project. The sixth phase of the public outreach, post-experiment, would include the publication of an expansive report on the project's public outreach, the publication of a scientific report, and the finalization of public outreach for the next set of experiments.

Figure 8: Public Outreach vs. Public Relations

In preparing her proposal, Dr. Kildow stressed that the plan she proposed dealt with “public outreach” and not “public relations.” According to Dr. Kildow, the two have very different goals and methodologies. Public outreach develops a consensus among the public and participate in the decisions that affect them. Public relations persuade the public to support a particular point of view. She stressed that scientists involved with the Hawaii project be forthcoming, concealing nothing. Instead of trying to persuade the public that carbon sequestration was correct, she urged the project to bring scientists together with the public to begin a dialogue that would build trust. Dr. Kildow intended her public outreach plan for the carbon sequestration experiment to set the standard for future scientific projects.

Dr. Kildow developed a draft public outreach proposal in February 1998 and submitted a final proposal to the Steering Committee in April 1998. She planned for the public outreach strategy to start immediately in April 1998, however the plan did not receive funding until nearly a year later. There was no provision in the initial project agreement for funding public outreach. An amended budget had to be agreed upon by all the sponsors, and this funding bureaucracy moved slowly. In retrospect, not engaging the public at the very beginning of the project made the residents of Hawaii distrust the project, as predicted by Dr. Kildow.

2.7 Identification of Public Outreach Contacts

In preparation for the project’s public outreach program, Dr. Kildow asked Mr. David Tarnas in early 1998 to assist the project in identifying key contacts for the public

outreach effort. Mr. Tarnas had extensive experience in marine and coastal issues, and had been Kona's representative to the Hawaii State Legislature.³⁴

The first group of contacts that Mr. Tarnas identified included individuals and organizations working adjacent to the project site at NELHA. These included NELHA tenants, government agencies with offices in the area, and the West Hawaii Explorations Academy, a charter school located in the NELHA research park. Tarnas identified the Keahole Point Tenants Association as probably the best group to approach since it included membership of most of the groups operating at NELHA's Keahole Point facility. These individuals and businesses would most likely be concerned with the experiment potentially degrading the surrounding environment, and the project team would need to respond to their concerns.

The second group to approach was identified as the Ho'ona Historic Preserve Advocates; the Ho'ona group had cultural ties to the NELHA land, and any disputes Ho'ona had with NELHA could impact the experiment.

The third group would be scientists and extension agents in the area. It was suggested that the project team meet with scientists from the Hawaii Department of Land and Natural Resources, information specialists from the Department, and extension agents from University of Hawaii Sea Grant Extension involved with fisheries and marine conservation.

³⁴ Mr. Tarnas served as State Representative to the 6th District of Hawaii from 1995 to 1998. He also served as Chairman of the House Committee on Ocean Recreation and Marine Resources. In the House he led numerous legislative initiatives, including the implementation of the Hawaii Ocean Resources Management Plan

The next group included representatives from the private sector. Potential contacts included individuals from local resorts, the local chamber of commerce, and community planners.

The fifth group encompassed key ocean advocates, particularly divers and ocean enthusiasts. Ocean advocates were very much forces to be reckoned with in Hawaii politics, and had a track record of strong mobilization efforts. People contacted included organizers of local ocean coalitions, ocean recreation leaders, shoreline coastal advocates, and environmental groups with an interest in the ocean such as the Sierra Club.

The sixth group to contact would be individuals with an interest in native Hawaiian ocean and coastal issues. These included the Island-of-Hawaii trustee for the Office of Hawaiian Affairs, and representatives of various native Hawaiian and ocean organizations based in Kona and the Big Island, such as Pai Ohana, Protect Kohanaiki Ohana, the Kai-Opua Canoe Club, and the Ahupua'a Alliance.

The next group of individuals was the West Hawaii Fishery Council. The Council advises the Hawaii Department of Land and Natural Resources on marine resource management, and its membership is chosen by the Department to provide a broad range of coastline interest groups.

The eighth and final group would be political leaders of the local and state level, such as the Mayor's office, county council, governor's office, state representatives, and relevant state legislative committees.

Mr. Tarnas advised the project to inform all of these groups as soon as possible about the experiment through group and individual meetings. The purpose of the meetings would be to tell them about the project, the public outreach effort and the

research team. Mr. Tarnas felt it was important that the project incorporate their input for making modifications to the experiment. With regard to the permitting process, several state agencies would need to be contacted, such as the Department of Health (responsible for water quality certification), Department of Land and Natural Resources (responsible for aquatic and historic preservation), Office of Hawaiian Affairs (cultural and Hawaiian issues), and of course NELHA. Federal agencies, such as the National Marine Fisheries Service, Army Corps of Engineers, and Environmental Protection Agency would also need to be contacted. At the county level, it would be useful to advise the County Planning Director. All contact was supposed to be made prior to an environmental assessment. The area of responsibility for identifying and contacting the agencies fell on the permitting team, rather than public outreach advisers.

From a public outreach perspective, the latter half of 1998 was spent revising the public outreach program. The project team could not proceed with the project application until it produced a public outreach plan that the NELHA board could be satisfied with. As a result, time was lost in getting the project started, and friction began to emerge between Dr. Kildow and NELHA.

2.8 Project Goes Public in West Hawaii Today

On March 18, 1999, the first article about the experiment was published on the front page of *West Hawaii Today* entitled, “Feds to test impact of dumping CO₂ into Kona waters.”³⁵ The article caught the project team off guard because the information had been gleaned from a third party. While they felt that the headline was slightly

³⁵ A copy of the article can be found in the appendix.

alarmist, the project team also felt that most of the contents were accurate as the reporter's main sources about carbon sequestration was the DOE website.

2.9 Aftermath of West Hawaii Today Article

The project's planned public outreach strategy still had not received funding at the time of the *West Hawaii Today* article's publication, which disappointed Dr. Kildow greatly. A question soon emerged: was it too late to begin a public outreach program? Optimally, a public outreach program requires public involvement from the beginning. PICHTR and NELHA became flooded with telephone calls from Kona residents and businesses expressing concern about the project. Dr. Tom Daniel, Scientific Director of NELHA, responded to the press and public inquiries made to him. An internal debate developed between Dr. Kildow and Dr. Daniel regarding the project's outreach strategy. Dr. Daniel felt obliged to respond to inquiries about the project that were made to NELHA; he felt that it was a matter of professional courtesy. Dr. Kildow, on the other hand, felt that the project should speak with one voice, and as coordinator of the public outreach effort, dealing with public inquiries was her responsibility. By having different spokespeople for the project, she felt it was doing the project more harm than good. On March 29, 1999, Dr. Kildow decided to resign herself from the project.

The project team asked Mr. Tarnas to assess the impact of the *West Hawaii Today* article on a public outreach strategy. Tarnas reported that local environmentalists were alarmed with the project, and were already organizing an opposition to prevent the experiment from occurring. Tarnas also found that the general public, as well as the environmental community, felt left out of the discussion; they were becoming suspicious

of the project. In Tarnas's opinion, there would be opposition to the project and the opportunity for a pure public outreach program had been lost. He suggested that: (1) the public outreach plan be revised; (2) the project move forward with a public outreach strategy, but with an accelerated involvement of the stakeholders; and (3) that the public must have the opportunity to learn about the experiment and have a hand in deciding whether Kona would be an appropriate site. He thought that some public relations techniques might be perceived as a sales job, and increase the public's skepticism of the project. PICHTR, nonetheless, hired the public relations firm Stryker Weiner to facilitate the project.

The project contracted with David Tarnas and Stryker Weiner to prepare a revised public outreach plan. The new plan had essentially the same contents of Dr. Kildow's plan, but was framed differently. The new plan included eight phases instead of the initial six, and paid significantly more attention to the permitting process. Permits would be more difficult to obtain now than when Dr. Kildow authored her public outreach program. In addition, the plan revised Dr. Kildow's timeline; Dr. Kildow's plan would have already been in its third phase by the time the *West Hawaii Today* article came out.

Figure 9: Phases of Revised Public Outreach Strategy

Phase 1	Information gathering and outreach preparation
Phase 2	Build enough community support to apply for NELHA permit
Phase 3	Apply for NELHA permit
Phase 4	Build enough community support to apply for other permits
Phase 5	Apply for other permits
Phase 6	Construction, pipe deployment, testing prior to experiment
Phase 7	Experiment
Phase 8	Community de-briefing following experiment

2.10 Public Outreach and Public Relations Programs in “Action”

Although the project team began developing a website for the project in September 1998, the site did not go online until about nine months later. Public awareness remained very much a part of the project team’s goals, and it wanted to make sure that everything put forth to the public was technically accurate and easily understandable. The project team spent a considerable amount of time revising the content of the project website, which was a major contributor to its delay. Although Dr. Kildow had already resigned from the project by the time the last revisions to the site were being made, the team tried to take into account her suggestions, such as incorporating project’s goals of public outreach into the website. An email address was included with the site that would allow the public to ask questions directly to the Technical Committee. The site went public in June 1999 at:
<http://www.co2experiment.org/>.

The project's first formal presentation to the public did not come until nearly five months after the *West Hawaii Today* article and almost a year and a half after Hawaii was selected to host the project. Although this may be perceived as sluggishness, the project team did sustain a public outreach program in early 1999. One of the reasons that outreach did not commence earlier was that the project's Steering Committee did not meet until about three months after the *West Hawaii Today* article came out; this meeting was where the budgets were finally secured for public outreach and additional permitting. The implementation of the revised public outreach plan went at a sustained pace in the late spring and summer of 1999. Being in Hawaii, the locally-based project members took that burden. More than fifty letters were sent to stakeholders and information packages were designed and taken along to meeting with several politicians in the State of Hawaii.

In the meantime, activists in the community were able to shape the perceptions of some members of the public towards the project—perceptions that developed into an opposition frame of reference.

PART II: Frames of Reference

3. The Sponsors

“We can’t say what the environmental impacts [of ocean sequestration] are because we don’t know...but if the experiments aren’t done, it’s hard to determine what the impacts are.”

- Robert Kane (U.S. Department of Energy)³⁶

The sponsors represented an international alliance of governmental bodies and firms funding the experiment. Although their motivations for the experiment varied, the project offered three major opportunities for the sponsors. First, the sponsor organizations came from countries that were significant producers or consumers of fossil fuels; by pursuing carbon sequestration, they could show the world that were not merely part of the problem, but rather part of the solution. Second, carbon sequestration offered some interesting technical challenges, appealing to the scientists within the governmental agencies. Third, carbon sequestration offered an opportunity to bring the concept from theory to commercialization.

3.1 Players

New Energy and Industrial Technology Development Organization (NEDO)
and Central Research Institute of Electric Power Industry (CRIEPI) – Japan

NEDO is a semi-governmental organization under the Ministry of Economy, Trade and Industry (METI). NEDO's activities include the development and promotion of new energy and energy conservation technologies, management of industrial technology research and development projects, restructuring of Japan's domestic coal

³⁶ E. Niler, “Plan to Store Carbon in Sea Runs Aground,” *The Boston Globe* April 10, 2001, p. B6.

mining industry, production of industrial alcohol, and restoration of damaged coal mining areas. In addition, NEDO promotes international cooperation involving joint R&D and information exchange.

CRIEPI is the major research institution for Japan's electric power industry. CRIEPI's research activities center on cost reductions and ensuring reliability, creation of comprehensive energy services, adaptation of trends in power market liberalization, response to environmental problems, and assuring energy security.

The work of NEDO and CRIEPI in carbon sequestration has included an environmental assessment for ocean sequestration of carbon dioxide, underground storage of carbon dioxide in Japan, and re-utilization of captured carbon dioxide to make methanol from coal or natural gas using solar energy.³⁷

The field experiment was appealing to Japan on several levels. The limited land size of Japan made ocean sequestration a more realizable sequestration option than terrestrial or geologic. Japan devoted a substantial budget to sequestration research. Japan's small land size also meant that it had a limited potential for renewable energy options, such as photovoltaic cells, which require a large "footprint". (Of course, nuclear energy plays a major role in Japan's energy portfolio.) Finally, Japan had a long-standing interest in sequestration, with research dating back at least a decade.³⁸

³⁷ IEA Greenhouse Gas R&D Programme, "CO₂ Sequestration" *Greenhouse Issues* 53 [Internet]; March 2002 [April 22, 2002]. Available from: <http://www.ieagreen.org.uk/march53.htm>.

³⁸ For more information on Japan's activities in sequestration, see: New Energy and Industrial Technology Development Organization [Internet], Tokyo (Japan): Energy and Environmental Technology Development Department; [cited May 8, 2002]. Available from: <http://www.nedo.go.jp/itd/fellow/english/list-e.html>; Research Institute of Innovative Technology for Earth [Internet], Kyoto (Japan): Research and Development Projects; [updated May 2, 2002; cited May 8, 2002], Available from: <http://www.rite.or.jp/English/welcome/proj.html>; Central Research Institute of Electric Power Industry [Internet], Tokyo (Japan): Research Topics; [cited December 5, 2002], Available from: http://criepi.denken.or.jp/eng/PR/topics_idx.html.

Department of Energy (DOE) – United States

DOE is the governmental energy body of the United States. The priorities of the Department are to increase domestic energy production, “revolutionize” the approach to energy conservation and efficiency, and to promote the development of renewable and alternative energy sources.³⁹ The National Energy Technology Laboratory (NETL) is the newest of DOE’s national laboratories and its mission is to “assure that U.S. fossil energy resources can meet increasing demand for affordable energy without compromising the quality of life for future generations of Americans.”⁴⁰ NETL’s main programs are in energy resources, including natural gas technologies, coal-fueled power systems, and fuel technology. Carbon sequestration is one of NETL’s science and technology development activities, with research being sponsored in capture and storage, geologic sequestration, ocean sequestration, terrestrial sequestration, advanced carbon dioxide conversion and reuse, and modeling and analysis. DOE’s Office of Fossil Energy oversees the carbon sequestration research activities at NETL and other DOE national laboratories. The Office is committed to sequestration research; currently carbon sequestration is the highest growth category in the fossil energy research and development budget. In Fiscal Year 2002, the office appropriated about \$32 million for sequestration research, out of a total coal research initiative budget of \$338 million.⁴¹ Like NEDO, DOE has spent over a decade researching carbon sequestration options. The activities have allowed the

³⁹ U.S. Department of Energy [Internet]. Washington (DC): *Our Mission*; [cited April 22, 2002]. Available from: <http://www.energy.gov/aboutus/history/mission.html>.

⁴⁰ National Energy Technology Laboratory [Internet], Pittsburgh (PA): *Welcome to NETL!* [cited April 22, 2002]. Available from <http://www.netl.doe.gov/welcome/welcome.html>.

⁴¹ U.S. Department of Energy Office of Fossil Energy [Internet], Washington (DC): *Fossil Energy Budget* [cited May 8, 2002]. Available from: http://www.fe.doe.gov/budget/03/budget_03table.shtml.

Office of Fossil Energy to carve out a niche on climate change research with respect to cleaner coal and electric power.⁴²

Norwegian Research Council (NRC) – Norway

NRC develops and implements Norway's national research strategy. It serves three roles: (1) a government adviser, identifying present and future needs for knowledge and research; (2) a funding agency for independent research programs and projects, strategic programs at research institutes, and Norwegian participation in international research programs; and (3) a coordinator, initiating networks and promoting cooperation between R&D institutions, ministries, business and industry, public agencies and enterprises, other sources of funding, and users of research. Norway is a major oil and gas producer. Its government is committed to strengthening research into the development of environmentally friendly energy technology, with a target to establish a framework that will make it possible to establish gas-fired power plants with CO₂ reduction technology.⁴³ Like NEDO and DOE, NRC's interest in sequestration is long-standing.⁴⁴

Commonwealth Scientific and Industrial Research Organization (CSIRO) – Australia

CSIRO is Australia's largest research organization. It has two primary functions: (1) to carry out scientific research, both assisting Australian industry and contributing to

⁴² For more information on DOE's sequestration research activities, see: U.S. Department of Energy Office of Fossil Energy [Internet], Washington (DC): Carbon Sequestration; [cited May 8, 2002]. Available from: http://www.fe.doe.gov/coal_power/sequestration/index.shtml.

⁴³ Ministry of the Environment [Internet], Oslo (Norway): Norwegian Climate Policy – Report No. 15 to the Storting; [cited May 8, 2002]. Available from: <http://odin.dep.no/md/engelsk/publ/stmeld/022051-040013/index-dok000-b-n-a.html>

⁴⁴ For more information on NRC sequestration research, see: The Research Council of Norway [Internet], Oslo (Norway): Main Page; [cited May 8, 2002]. Available from: <http://www.forskningsradet.no/english/>.

national and international objectives; and (2) to encourage or facilitate the application and use of the results of scientific research. Its petroleum division has a research interest in carbon sequestration, especially with regard to injection of carbon dioxide into depleted or saline reservoirs. Australia has been the world's largest coal exporter since the mid-1980s.⁴⁵ Its interest in carbon management has been mainly from a research standpoint and not commercial. Australia's geography provides it with an obvious interest in ocean sequestration, and much of the country's research has been in iron fertilization.⁴⁶

Natural Resources Canada (NRCan) – Canada

NRCan is an agency of the Canadian government specializing in the sustainable development and use of natural resources. NRCan's interest in the Kona field experiment was mainly from a research point of view; several Canadian researchers were interested in taking an active role in the experimental design and implementation.⁴⁷ Canada's interest in carbon sequestration has traditionally been in terrestrial and geologic forms, however ocean sequestration could certainly be considered within Canada's portfolio of options.

Asea Brown Boveri (ABB) Corporate Research Ltd. – Switzerland

ABB is a leading multinational company in the field of electrotechnical engineering, with research headquarters in Switzerland. The Energy and Global Change

⁴⁵ U.S. Department of Energy, Energy Information Administration [Internet], Washington (DC): Australia Environmental Issues; [updated May 2000; cited May 8, 2002]. Available from: <http://www.eia.doe.gov/emeu/cabs/ausenv.html>.

⁴⁶ For more information on CSIRO sequestration research, see: Commonwealth Scientific and Industrial Research Organization [Internet], Campbell (Australia): CSIRO Solutions for Greenhouse; [updated June 24, 1999; cited May 8, 2002]. Available from: <http://www.csiro.au/csiro/ghsolutions/s6.html>.

⁴⁷ For more information on NRC, see: Natural Resources Canada [Internet], Ottawa (Canada): English Home Page; [cited May 8, 2002]. Available from: <http://www.nrcan.gc.ca/>.

Department of ABB Corporate Research represents ABB in many international programs in the area of global environment, greenhouse gas control technologies, and fossil fuel technologies. ABB supports and participates in a number of programs including the MIT Joint Program on the Science and Policy of Global Change, the Alliance for Global Sustainability, the R&D Program on Technologies to Limit Greenhouse Gas Emissions run under the International Energy Agency, the Clean and Efficient Combustion of Coal research program at Tsinghua University in China, and of course the carbon dioxide field experiment.⁴⁸ ABB is very interested in carbon sequestration research. In the early 1990s, ABB began licensing and further developing a carbon sequestration technology with the firm Kerr-McGee that can be used to capture carbon dioxide from power plant flue gases based on any fuel ranging from natural gas to coal, coke, or other high sulfur fuels.⁴⁹

3.2 What the Sponsors Thought About the Experiment

The sponsors' views on the project were not consistent. DOE, NEDO, NRC, and ABB had different reasons for pursuing the project; CSIRO and NRCan shared a common interest. While all of the sponsors shared a common interest in ocean carbon sequestration research, they had different motivations for the outcome.

⁴⁸ The ABB Group [Internet], Baden-Daetwil (Switzerland): ABB's Participation in International Global Environmental Programs; [cited May 8, 2002]. Available from: <http://www.abb.com/global/abbzh/abbzh251.nsf!OpenDatabase&db=/GLOBAL/ABBZH/abbzh254.nsf&v=594A&e=us&c=A9BDAC6608831DA2C1256803007E943B>.

⁴⁹ For more information on ABB's sequestration activities, see: The ABB Group [Internet], Baden-Daetwil (Switzerland): Emissions Reductions – Carbon Sequestration; [cited May 8, 2002]. Available from: <http://www.abb.com/global/usabb/usabb045.nsf!OpenDatabase&db=/global/usabb/usabb048.nsf&v=A26&e=us&c=F2945B3CD38DCCEB85256AE0005D0F27>.

DOE felt that carbon sequestration should be investigated as one of three portfolios of options: efficiency, renewables, and carbon management. Although DOE was interested in the experiment for research purposes, it also wanted to send a message to the world.⁵⁰ By hosting the international project in the United States, DOE felt that it could send a message that the world's biggest emitter of carbon dioxide was taking steps to address the problem. DOE did face some internal conflicts. When it became evident in February 2001 that the local Hawaii environmental community was becoming more vocal in its opposition to the project, NETL approached DOE Headquarters, asking for guidance from as high a level as possible. In essence, NETL was asking for a statement from the Secretary of Energy expressing support for the experiment. Bob Kane, Global Climate Change/Carbon Sequestration Issue Manager was requested to initiate a Secretary's verbal consent to move forward on the experiment.⁵¹

For NEDO, ocean carbon sequestration represented the most likely Japanese carbon sequestration option. Geologic sequestration is very limited because Japan lacks indigenous fossil fuel resources and is located in a somewhat geologically unstable area. When the ocean experiment was initially planned for the summer of 2000, NEDO did not think it would be able to obtain permits fast enough to site an experiment in Japan by that deadline. The experiment date was later moved to 2001; the international collaboration probably would have considered Japan as an option given that time scale. Another factor that restricted locating the experiment in Japan was the Japanese vision for an

⁵⁰ P. Bergman, personal communication (November 15, 2001), Project Manager, National Energy Technology Laboratory, U.S. Department of Energy, Building 922, Room 262, P. O. Box 10940, Pittsburgh, PA 15236-0940, Tel: 412-386-4890, Email: bergman@netl.doe.gov.

⁵¹ R. Kane, personal communication (December 5, 2001), Global Climate Change/Sequestration Issue Manager, Office of Fossil Energy (FE-26), U.S. Department of Energy, Washington, DC 20585, Tel: 202-586-4753, Email: robert.kane@hq.doe.gov.

“international” collaboration. Japan’s share of funding for the project was over 65%. The Japanese were afraid that by locating the experiment in Japan, there would be an appearance to the public that the experiment was merely a domestic effort and not the international collaboration that it really was.

NRC’s interest in the experiment was an extension of carbon dioxide work that Norway had been doing already. In 1991, Norway imposed a \$55/ton of carbon dioxide tax on emissions from power plants and off-shore oil and gas production. Statoil, Norway’s state oil company, operates the Sleipner offshore natural gas facility in the North Sea. The natural gas has a CO₂ concentration of 9%, which is above the European export specifications of 2.5%.⁵² Statoil strips off the excess CO₂ and injects it into an underground aquifer, resulting in no tax for CO₂ emissions, a savings of about \$50 million per year. NRC is also interested in sequestration from a research standpoint.

ABB was the world’s largest electrical engineering contractor. Although its involvement with the experiment is through its research subsidiary, ABB has a commercialization interest in ocean carbon sequestration. According to the Pew Center on Global Climate Change, ABB has built power plants in Costa Rica that could allow for 4 million tons of avoided CO₂ emissions if an international CO₂ permit trading system was established.⁵³ According to ABB, CO₂ credits could be sold on the international market through “carbon offset trading.”⁵⁴

⁵² Royal Commission on Environmental Pollution [Internet], London (United Kingdom): Carbon Resources and Removal – Technical Issues; (updated June 16, 2000; cited May 8, 2002). Available from: <http://www.rcep.org.uk/pdf/app-d.pdf>.

⁵³ Pew Center on Global Climate Change [Internet], Arlington (VA): *Policymaker’s Guide*; [cited April 22, 2002]. Available from: http://www.pewclimate.org/policyguide/business_agreement.cfm.

⁵⁴ Ibid.

CSIRO and NRC are involved in the project for research reasons. A number of scientists from their respective countries had interests in oceanography and climate modeling. The researchers were interested in observing the project and asked the Technical and Steering Committees to join the project so that they could participate on a more formal basis.

3.3 PICHTR

Although PICHTR was not a sponsor of the project, it was hired by the sponsors to serve as a general contractor for the project. PICHTR is a non-profit group with an interest in bringing sustainable development practices to Hawaii. For example, it had worked on a number of projects involving biomass systems, ocean thermal energy conversion, and distributed power. PICHTR's charge was to develop the experimental infrastructure and implement the test plan designed by the Technical Committee.

4. The Scientists

My opinion, from looking at the data, and from what I know about deep-sea biology is that the impacts of this experiment are likely to be so small as to be immeasurable. A major challenge for us biologists will be to see any effects whatsoever.

– Craig Smith, Marine Biologist at University of Hawaii⁵⁵

4.1 Players

The project's technical committee comprised most of the scientists involved with the project. A comprehensive listing of the committee can be found in the appendix.

4.2 What the Scientists Thought About the Experiment

For the scientists, the experiment was simply a scientific project to produce scientific outputs for a scientific audience. Some of the scientists had spent much of the preceding decade working on models for the potential physical, chemical and biological impacts of carbon dioxide in seawater, and they were looking for data to verify their models. In particular, they sought to: (1) test nozzle designs and observe droplet behavior in the near field; (2) study droplet/plume interaction and intrusion dynamics in the intermediate field by measuring pH and plume velocity; and (3) measuring ambient diffusivity in the far field.⁵⁶

Some of the scientists were eventually placed in the role of project spokespeople, which they were very uncomfortable with for a couple reasons. First, as active research scientists, they did not have the time to serve as an effective public outreach liaison.

⁵⁵ C. Berger, "Ocean Carbon Experiment Is Put on Hold: Setback for Science, or Win for Environment?" *Environment Hawaii* 12 (September 2001), pp. 1, 8-10.

⁵⁶ See Adams, Note 1.

Second, they had no training in dealing with the public; while the scientists were well versed in their specific scientific disciplines, they had no experience coordinating a public debate. Initially, the scientists were fairly confident that marine biologists would not need to be on the Technical Committee. They felt that the amount of carbon dioxide being injected into the ocean was negligible, and therefore would result in no biological impact. They felt that biologists would be left with nothing to do. University of Hawaii biologist Craig Smith was added to the Technical Committee upon the recommendation of Dr. Edith Chave, who was retiring from University of Hawaii and had analyzed video footage of the experimental site.⁵⁷ Finally, the scientists were a bit perplexed by the attitudes of the public with regard to carbon dioxide, sequestration, and climate change. One of the possible consequences of global climate change is sea level rise. Several scientists on the project team thought that residents of Hawaii would jump at the chance to research carbon sequestration because sea level rise and coral reef bleaching would significantly affect Hawaii. Some scientists were also confused by the attitudes of the public toward sequestration. Carbon sequestration had been conducted for years in the form of injecting carbon dioxide into oil wells to enhance the recovery of oil; there were no public conflicts. The technical underpinnings of carbon sequestration were extremely well understood. The scientists did not anticipate that the project would be confronted with a significant amount of opposition, although they were aware that concerns might be brought by the community.

⁵⁷ Although Dr. Smith was formally added to the Technical Committee in 2000, he had attended committee meetings prior to his appointment.

5. The Opposition

“Some experts say killing life in a small part of the ocean is preferable to a continued increase of carbon dioxide in the atmosphere. But environmentalists are horrified, and many biologists are worried, too.”

- Marla Cone in *Los Angeles Times*, August 25, 2000.

“The big, wealthy, vocal kids on the block did not want it in their yard so they decided to test it in Hawaii’s back yard because they didn’t think we would do anything about it...”

- Joe Willis (letter to editor) in *West Hawaii Today*,
January 19, 2001

“We cannot afford to risk our marine environment or resources simply to satisfy the scientific curiosity of what happens to CO₂ after it is pumped into the ocean.”

- Isaac Harp in *Hawaii Island Journal*, February 1-15,
2001

“...In the absence of peer reviews, hypotheses, and relevant scientific references your proposal looks more like a large scale technology feasibility study run by engineers than it does a scientific experiment. Don’t be surprised when the community mobilizes to protect itself.”

- David Holzman (letter to editor) in *West Hawaii Today*,
February 2, 2001

“If Bush is not going to follow the Kyoto Protocol...then why allow this experiment?”

- Kevin Seither (local attorney) in *West Hawaii Today*,
April 15, 2001

The project opposition was composed of three main groups: (1) those opposed to the experiment in and of itself; (2) those opposed to ocean sequestration but not necessarily to all forms of sequestration; and (3) those opposed to all forms of sequestration. The views of the opposition were not necessarily indicative of the views of the entire public, however it did appear that those in the public opposing the project were much more vocal than the proponents in the public.

5.1 Those Opposed to the Experiment

Those opposed to the experiment itself were generally comprised of the Kona fishing community and some supporters of Hawaii sovereignty. While they were not necessarily against the concept of sequestration, they were not supportive of the experiments taking place in Hawaii, also known as “not in my backyard” or “NIMBY”.

Many of them felt that the experiments should take place in other countries that were significant funding contributors to the experiment, such as Japan or Norway. They felt that this was yet another example of outsiders coming into the Hawaii community because they did not want to ruin their own environments.⁵⁸ Some of these feelings played out into xenophobia; for example, project scientists were compared to Nazis in the local newspaper.⁵⁹

The Kona community had a previous bad experience when the U.S. Navy sought to study Low Frequency Active Sonar (LFAS).⁶⁰ LFAS relies on high-intensity signals to detect acoustically quiet submarines. A LFAS experiment was conducted off Keahole Point in early 1998. A sound source that periodically generated low frequency sounds was placed on the ocean floor, and one of the goals of the experiment was to determine whether whales could be harmed by the noise. Whales use their acute sense of hearing to navigate, feed, mate and communicate in the ocean. While the scientists found no health impacts to whales, a dead whale was found in the area during the time of the experiments,

⁵⁸D. Holzman, “Earn the respect,” *West Hawaii Today*, February 2, 2001, p. 11A.

⁵⁹ “Hitler’s doctors and scientists perpetrated some of the most cruel and inhumane acts known to man against their fellow human beings, all in the name of science. ...What matters is that a foreigner wants to come here and poison the water of my home. My advice is go home and poison your own water. ...[The project scientists don’t] really know what deadly or disastrous effect pumping tons of poison into the ocean here might have.” – *Richie Lambeth (letter to editor) in West Hawaii Today, February 18, 2001*

⁶⁰ J. Kildow, personal communication (October 8, 2001), Senior Research Scientist, The Wrigley Institute for Environmental Studies, University of Southern California, 3616 Trousdale Parkway, Allan Hancock Foundation 232, Los Angeles, CA, 90089, Tel: 213-740-5539, Email: jkildow@wrigley.usc.edu.

and some residents claim the number of whales coming back to Keahole has not ever been the same. Stephanie Harrington argued that there was a lack of appropriate participation and a lack of trusted information.⁶¹ As a result, scientists felt that the public was insulting them, and the public felt that the scientists were trying to “sell” an experiment to the community.⁶²

Some felt that the scientists had a predetermined agenda in the sequestration case as well. They thought that there was a great deal of uncertainty, especially with regard to biological issues, that the project team was ignoring. Instead of providing an unbiased analysis of all the data, they felt that the scientists were proponents of carbon sequestration. In addition, they felt that the sponsors were encouraging the scientists to inject the carbon dioxide at shallow depths due to cost considerations. Injecting at a deeper depth would achieve longer storage and fewer ecological impacts, but they argued that it would make carbon sequestration even more cost prohibitive.

Tenants of Keahole Point were also concerned with the potential for CO₂ to be sucked into NELHA’s water intake pipes, which could potentially affect their aquaculture businesses. The heads of the two largest aquaculture firms at NELHA – Mark Huntley of Aquasearch and Gerald Cysewski of Cyanotech – supported the project, however, they were concerned with the impact of public perception on their marketing efforts. They encouraged the project to move farther away from the intake pipelines within the research corridor.

⁶¹ Harrington, S. 1998. New policy protocols for marine scientific research: lessons learned from past case studies. *MIT Masters Thesis*.

⁶² Ibid.

5.2 Those Opposed to Ocean Sequestration

There was a contingent in the Kona community not against geologic sequestration, but opposed to ocean sequestration. This group believed that it is too much of a risk to the marine fauna to pursue ocean sequestration. Geologic sequestration did not pose the same threat that ocean sequestration did. Those opposed to ocean sequestration cited an eruption at Lake Nyos in the Cameroon as an example of the potential for disaster.⁶³ This group argued that a serious deficiency to the project was the lack of an ecologist or marine biologist team member. This group also felt that the project scientists had been putting a spin on the experiment. They argued that ocean sequestration was not actually “sequestration” but rather the “dumping” of carbon dioxide into the ocean. Native Hawaiians felt that the project scientists were being sacrilegious by contaminating the ocean and endangering the marine animals.

5.3 Those Opposed to Carbon Sequestration

Those against carbon sequestration in general felt that scientists were going at the problem all wrong. They believed that the way to address carbon was to prevent pollution in the first place rather than clean it up after the fact. They felt that the resources being spent on carbon sequestration were resources not being spent on energy efficiency and renewables. They believed that carbon sequestration placed the world on a

⁶³ In 1986, there was an underwater eruption of the lake that released CO₂ into the air. The gas flowed down a stream valley, suffocating the residents who lived along the valley; over 1,700 people were killed. Interestingly, Lake Nyos is pertinent to potential safety problems with *geologic* sequestration and not relevant to potential problems with the *ocean* field experiment. Lake Nyos is not applicable to ocean sequestration due to the size of the ocean reservoir (which makes the formation of carbon-near-saturated waters nearly impossible) and injection depth much deeper than the liquid-gas boundary for carbon dioxide. For more information about Lake Nyos, see: C. Stager, “Cameroon’s Killer Lake,” *National Geographic* 172 (September 1987): 404-420.

pathway for further fossil fuel use. This group opposed the experiment not due to environmental consequences, but because of what the experiment might lead to. According to the plan of the sponsors, there would be further large-scale ocean sequestration projects if the initial experiment was successful. Thus while some members of the opposition agreed with the project scientists that there would not be a substantial environmental impact, they thought that the experiment would lead the world on a road to disaster by leading the world on a sequestration path. By opposing the project early, they could effectively prevent carbon sequestration from occurring later.

5.4 Questions From the Public

Following the public scoping meeting in October 2000, the project team received hundreds of emails through the project website. Members of the project, especially those in Hawaii, responded to all inquiries. In particular, the Technical Committee spent a considerable amount of time responding to the questions of Mr. Isaac Harp, an advocate of native Hawaiian rights who mobilized the opposition. Mr. Harp submitted a list of 69 questions inquiring about technical aspects of the experiment and policy motivations for the experiment. Harp's questions and analyses provided by the Technical Committee were so comprehensive that the project team decided to post them on the experiment website.

5.4 Coalition Against CO₂ Dumping

On February 18, 2001, the groups opposed to the Kona experiment mobilized to form the "Coalition Against CO₂ Dumping." Mr. Harp and Dr. Rob Wilder, who was

then Director of Conservation Programs for the Pacific Whale Foundation, led the Coalition.⁶⁴ Mr. Harp was concerned with maintaining Hawaii's sovereignty over its oceans, while Dr. Wilder was concerned with the impact and uncertainty surrounding biology in ocean carbon sequestration. The meeting served as a mobilization point to get the Kona public involved in opposing the experiment. The Coalition coordinated an extensive email and letter writing campaign against the experiment. In addition to its meetings, it relied on email and Internet discussion boards to spread its message—possibly one of the first instances that a group successfully used the Internet to coordinate an opposition campaign.

⁶⁴ The Pacific Whale Foundation is a non-profit group based in Kihei, Hawaii. It focuses on marine research, marine education, and conservation programs. The Foundation's conservation programs work with other non-governmental organizations, government agencies, and lawmakers to protect whales, dolphins, coral reefs and the oceans, and to promote legislation and practices which will improve the health and viability of the ocean and its' inhabitants. Examples of conservation programs include protecting whales against low frequency active sonar, banning the slaughter of whales in international waters, and protecting whale sanctuaries.

PART III: The Battles

6. Battle #1: NELHA

“The coalition presented its case to the NELHA board, basically saying, ‘this is crazy, you don’t want to do this.’”
– Jay Scharf, *Coalition Against CO₂ Dumping*⁶⁵

6.1 Facts

One of the primary reasons that Hawaii was chosen as the site of the experiment was the existence of NELHA’s “ocean research corridor” at Keahole Point. The project team was under the impression that a research corridor would provide advantages for obtaining permits quicker than if the project took place at an alternate site. Although NELHA operated an ocean research corridor, most of NELHA’s revenues came from incubating start-up companies, not the research business.⁶⁶ NELHA was mandated by the Hawaii State Legislature to sustain itself from a budgetary standpoint. It therefore sought to attract long-term business ventures. Although the project team saw the Hawaii field experiment as a one-time event, NELHA may have seen a future business opportunity in carbon sequestration. In any case, the perceptions that NELHA and the project team had at the beginning of the experiment were incorrect.

Although the experiment was planned for Keahole Point, the project needed to submit a formal proposal to NELHA’s Board of Directors. After the project agreement was signed in Kyoto, the project team did not approach NELHA with great urgency to have the experiment approved. The project team’s main concern was to ensure the

⁶⁵ See Berger, Note 55.

⁶⁶ Hawaii Island Economic Development Board [Internet], Hilo (HI): Island Economy Grows with Natural Energy Lab Resources; [cited May 8, 2002]. Available from: <http://www.hiedb.org/showtxt.asp?category=articles&artid=22>.

technical validity of the experiment. After the technical details were finalized by the Technical Committee, they planned to submit a proposal to NELHA for review.

PICHTR, general contractor for the project, made some initial contacts with NELHA's Board, and the Board expressed interest in revising the Kildow public outreach plan.

After the *West Hawaii Today* article came out, the dynamic of the project changed. The project management was now under a great deal of public scrutiny. In addition, the project team was under pressure from project management to gain NELHA approval. NELHA's involvement would be a symbol to the residents that Hawaii organizations supported the experiment. In October 19, 1999, NELHA's board approved the project.

The project team also wanted to respond to the public's concerns about the experiment. A suggestion from NELHA tenants was that the experiment should take place farther away from shore because of the perception that the experiment might interfere with businesses at Keahole Point and because of its proximity to historic preservation areas. The project team had actually already been discussing the option of an offshore CO₂ delivery system. There was a coral reef system on the ocean floor at Keahole that the project team would need to maneuver around in order to remain the reef undisturbed. This would result in substantial cost increases. In March 2000, the project team decided to use a CO₂ delivery system housed on a ship. A Norway deep spill experiment in the summer of 2000 reinforced the project team's decision, demonstrating that a ship-mounted system was not only achievable, but also cost effective.⁶⁷

⁶⁷ H. Herzog, personal communication (May 6, 2002), Principal Research Engineer, Laboratory for Energy and the Environment, Massachusetts Institute of Technology, Room E40-471, 77 Massachusetts Avenue, Cambridge, MA 02139, Tel: 617-253-0688, Email: hjherzog@mit.edu.

As the project team moved further into the experiment, it realized that NELHA's ocean research corridor conferred no permitting advantages. The experiment would still need to go through a process to obtain federal, state, and local permits. Although NELHA offered to serve as a "go between" for obtaining permits, permits would still need to be obtained. In essence, the project team's definition of an ocean research corridor and what NELHA called an ocean research corridor were two different things. Permitting played a secondary role in the project team's decision to change to an offshore CO₂ delivery system. The number of permits required and agencies that need to be involved in a decision is inversely proportional to how close the project is to shore. By moving farther away from shore, the regulations governing the project would be federal; the need for local and state permits would be eliminated.

The change in CO₂ delivery system, coupled with the lack of permitting advantages in the corridor, meant that the project's need for NELHA's ocean research corridor was now largely eliminated. Deep water close to shore was no longer a primary consideration for the project and the same permits would need to be obtained whether the project was housed at NELHA or otherwise. Of course, the oceanographic conditions were still attractive to the project team, with calm seas practically all the time.

While the project team was going through its decision process, NELHA had a decision of its own to make. NELHA was under huge pressure from the project's opposition to retract its approval. On the other hand, NELHA faced little pressure from the project team to keep the project because the research corridor no longer mattered to it. Further, NELHA saw no business potential in the project; in fact, NELHA was now receiving bad press as a result of the project. The project team made it clear that this

would be a research experiment and nothing more. On February 20, 2001, NELHA's board of directors voted to withdraw its support for the project. NELHA would allow the project to reapply for the permit, but the project declined. NELHA's decision caught the project off-guard.⁶⁸ While some opposition groups spun the decision as NELHA's disappointment with the technical merits of the experiment, the project team was able to put NELHA on public record that the withdrawal was not due to technical reasons, but rather contractual reasons—the decision to move from a shore-based CO₂ delivery system to a ship-based system constituted a major change in the project contract.⁶⁹ The project team, however, had received casual verbal assurances that the design change would not necessitate an amendment of its project application.⁷⁰

6.2 Positions

Project Team

The project team wanted the project to go forward, with or without NELHA. Keahole Point certainly conferred advantages of deep water and favorable wind. If NELHA provided the fastest and best opportunity for success, then the team was happy to conduct the experiment at NELHA's facility. From a technical standpoint, while an on-shore CO₂ delivery system might be easier to troubleshoot, it presented some challenges in trying to lay it on the ocean floor without disturbing the coral reefs and in

⁶⁸ It is interesting to note that the project team was first notified about NELHA's decision the next day when Bobby Command of *West Hawaii Today* called PICHTR asking for an official comment. Nihous received a call from NELHA later that morning explaining the board's rationale.

⁶⁹ See Berger, Note 55.

⁷⁰ G. Nihous, personal communication (May 24, 2002), Senior Project Engineer, Pacific International Center for High Technology Research, Building 5, Bay 14, 1020 Auahi Street, Honolulu, HI 96814, Tel: 617-591-6490, Email: gerard.nihous@pichtr.org.

creating a retrievable delivery system. With NELHA's research corridor losing its significant advantages, the project team saw that the experiment would need to move from NELHA at some point. Instead of the calculated retreat that the project team would have preferred, however, it found itself twisting in the wind.

Opposition

As a public institution, the opposition saw that NELHA would be vulnerable to local opposition. The Coalition Against CO₂ Dumping was just getting organized. Although it did contain members of the community, the organization was still seeking legitimacy. If it was able to compel NELHA into rescinding the project's approval, the Coalition could demonstrate to the public that it could get things done. With the project not housed at NELHA, it would present a first step to stopping the experiment from occurring in Hawaii entirely.

6.3 Result of Battle

The opposition fought hard to have NELHA rescind its approval of the project. The project team put up little resistance, relatively speaking, given the limited resources it had at its disposal. As a result, the opposition won the battle, however it was essentially an uncontested victory.

6.4 Commentary

With NELHA withdrawing approval, the Coalition had new ammunition against the project: NELHA’s Board opposed the project—you should too. The opposition tried to convey to the public that NELHA opposed the project due to bad science. Some time in early February 2001, Jay Scharf and David Holzman, two of the leaders of the Coalition Against CO₂ Dumping, met with NELHA Executive Director Jeff Smith to express their opposition to the project.⁷¹ In characterizing the meeting, Scharf said, “the Coalition presented its case to the NELHA board, basically saying, ‘this is crazy, you don’t want to do this.’”⁷²

If the project team did put up a battle, it was that it fought hard to get NELHA on record that its rationale was contractual and not technical in nature. In initial media reports, it appeared that the decision was not portrayed as contractual. Jeff Smith was quoted as saying: “The decision was based on everything—science, what it would do for the island and the community—and we came to the conclusion that it would not be in the best interest of NELHA to allow it to be conducted in the corridor.”⁷³ The project team pushed Smith on this issue. In front of the Energy and Environmental Protection Committee to the Hawaii State House, Smith testified that the decision was against neither the science nor scientists, but rather that the withdrawal of support was

⁷¹ Jay Scharf is Conservation Co-Chair of the Sierra Club Moku Loa Group in Hilo, Hawaii. Dr. David Holzman is a Kona sociologist and community activist.

⁷² See Berger, Note 55.

⁷³ B. Command, “Approval Repealed for CO₂ Experiments,” *West Hawaii Today* [Internet]; February 22, 2001 [cited April 22, 2002]. Available from: <http://www.westhawaii.com/daily/2001/Feb-22-Thu-2001/news/news1.html>.

contractual. The change in CO₂ delivery changed the terms of the contract, rendering it void.

With the limited resources at its disposal, the project team thought that this was not a battle worth fighting for. Given that the opposition used the NELHA Board decision as a basis for future opposition, an interesting question is raised. If the project team had fought this battle and was successful, would the subsequent battles have been necessary?

7. Battle #2: Legislature

“Now that the House committee has passed the resolution, we have some ammunition when they apply for their permits. That’s why we wanted this resolution.”

- David Holzman (*Coalition Against CO₂ Dumping*) in *West Hawaii Today*⁷⁴

7.1 Facts

Riding on its NELHA “victory”, the opposition went to the Hawaii State Legislature to obtain a ban on the project. Four resolutions were introduced in the legislature in March 2001, three of which were killed in committee, i.e. no discussions of the resolutions took place.⁷⁵ Discussion in this section will be limited to the resolution that was debated in committee; summaries of the other three resolutions can be found in the appendix.

The resolution that did make it to an Energy and Environmental Protection Committee hearing on March 22, 2001 “opposed any resumption of the proposal to conduct carbon dioxide experiments off the Kona coast.” Proponents of the resolution, those against the experiment, offered testimony in oral and written forms. Among the reasons cited were NELHA’s denial of a permit to the project, the potential for “significant” damage to biological life, the cultural and religious sanctity of the ocean, economic liability due to decreased tourism, and the international nature of project funding.

⁷⁴ B. Command, “Resolution Addresses CO₂ Plan,” *West Hawaii Today* [Internet]; April 6, 2001 [cited April 22, 2002]. Available from: <http://www.westhawaii.com/daily/2001/Apr-06-Fri-2001/news/news1.html>.

⁷⁵ A legislative *resolution* is different than a *law*. A resolution expresses an opinion of the legislature and is non-binding; a law is binding upon the public.

Unlike the NELHA battle, the legislative battle was one that the project team intended to win. Testimony was gathered from twenty-four scientists throughout the world opposing the resolution, as well as the Executive Director of NELHA and the Chair of NELHA's Research Advisory Board. NELHA's representatives testified that the retraction of the permit was due to contractual reasons and not due to lack of scientific merit. The scientists testified that the study of climate change options was important given the potential for large environmental impacts. They said that they were not advocating carbon sequestration, but were interested in gathering information in the event that carbon sequestration may be used as a mitigation option in the future. They emphasized that the project was meeting, and sometimes exceeding, applicable federal, state, and local regulations. Finally, they testified that there would be no significant impact on the environment by the experiment; the amount of carbon dioxide being released by the experiment was very small—for example orders of magnitude smaller than the amount of carbon dioxide being released into the ocean by volcanoes in Hawaii.

After the committee hearing, it was clear that the legislature would not be willing to oppose the experiment.⁷⁶ The proponents of the resolution redrafted it to make it more amenable to passage by the legislature. The new resolution called for the U.S. Congress to enact stronger energy efficiency and renewable policies. It also resolved that the carbon dioxide experiment comply with applicable regulations, which the project team was doing anyway. The revised resolution passed its committee unanimously on April 5, 2001. The new resolution passed both the Hawaii House and Senate, and was adopted on

⁷⁶ Interestingly, during the hearing, some committee members expressed concern not that the project posed harm, but that it might impact on their personal agendas for renewable energy technologies.

April 25, 2001 as HCR64 HD1 SD1. A copy of the final resolution and its legislative history can be found in the appendix of this thesis.

7.2 Positions

Project Team

For the project team, winning the legislature battle was a big deal. They felt that the initial resolution draft mischaracterized the events that transpired and did not address the purpose of the experiment accurately. The project team felt that the environmental impacts of the project were minimal at most. It sought to call into question the fundamental principles of the initial draft by showing that NELHA did not withdraw support for the experiment on scientific grounds. The revised resolution was essentially neutral toward the experiment, and thus the project team did not use its limited resources against the new resolution.

Opposition

Given the NELHA developments, the opposition thought that it could press harder to have the project driven out of Hawaii completely. In addition, a legislative success could lend the Coalition more legitimacy. The legislative resolution provided a public forum in which the opposition could express its concerns about the experiment. Although it was interested in having the legislature ban the project, any legislative involvement would be spun as a success for the opposition.

7.3 Result of Battle

The project team won this battle. It was able to get the first resolution draft that banned the experiment thrown out, replaced by a resolution that was neutral to the experiment.

7.4 Commentary

The legislative battle showed that the project team could be very successful when its members banded together around a specific cause. The NELHA battle was unsuccessful for the project team because it chose not to fight the battle. In the case of the legislature, however, the project team was able to solicit testimony from scientists throughout the world in a relatively short period of time

The opposition claimed that it was victorious because it was able to have a resolution passed through the Hawaii State Legislature, however, the merits of that claim are questionable because the opposition did not achieve its goal of getting the experiment banned from Hawaii all together.

It is also interesting to note that the legislature did not buckle under public pressure as was the case in NELHA. Although NELHA claimed that the reason it withdrew its support from the experiment was contractual, it appears that the reality of the situation was that NELHA was facing significant vocal opposition to the experiment. The legislature also saw large opposition to the project—perhaps even larger than the opposition in the NELHA battle—yet the legislature recognized that it could only support resolutions based on complete information on all options. David Reiner notes that arguably it is the legislature that is supposed to be more responsive to public outcry; the

legislature's tepid support of the first resolution may be an indicator that the opposition was a minority in the public.⁷⁷

⁷⁷ D. Reiner, personal communication (May 7, 2002), Post-Doctoral Associate, Laboratory for Energy and the Environment, Massachusetts Institute of Technology, Room E40-486, 77 Massachusetts Avenue, Cambridge, MA 02139, Tel: 617-253-5681, Email: dmreiner@mit.edu.

8. Permitting

“Delays are costly, and it’s possible we’ll need more money when we do conduct the projects.”
- Gerard Nihous, *PICHTR*⁷⁸

8.1 Facts

In August 1998, a project questionnaire required under the National Environmental Policy Act (NEPA) was submitted to Mr. Lloyd Lorenzi, NEPA Compliance Officer at DOE. NEPA requires all DOE projects that may affect the environment to undergo a heightened scrutiny unless they can receive a special exemption, known as a “categorical exclusion.”⁷⁹

⁷⁸ P. Natarajan, “Protests May Drive Away \$5 Mil in Research,” *Pacific Business News*, June 8, 2001, pp. 1, 7.

⁷⁹ For more information on the process by which DOE makes categorical exclusion determinations, see: U.S. Department of Energy [Internet], Washington (DC): Guidance on National Environmental Policy Act Categorical Exclusion Determination; [updated January 16, 1998; cited May 8, 2002]. Available from: <http://tis.eh.doe.gov/nepa/tools/guidance/cx-fin1.htm>.

Figure 10: National Environmental Policy Act (NEPA)

The National Environmental Policy Act (42 U.S.C. s/s 4321 et seq., 1969) applies to all federal activities that could significantly affect the environment. The NEPA process requires that all federal agencies consider the environmental impacts of proposed actions, that the public be informed of the potential environmental impacts of proposed actions, and that the public be involved in planning and analysis relevant to actions that impact the environment. The most visible NEPA requirements are the preparation of environmental assessments or environmental impact statements.

Categorical exclusion is a category of actions that do not individually or cumulatively have a significant effect on the human environment, and are therefore not subject to an environmental assessment (EA) or environmental impact statement (EIS). 40 CFR 1508.4

An EA is a concise public document that provides sufficient evidence and analysis for determining whether to prepare an EIS or a finding of no significant impact (FONSI). 40 CFR 1508.9

An EIS is a public document prepared for actions that may have a significant impact on the quality of the human environment. 40 CFR 1508.11

A FONSI is a document that presents the reasons why an action not otherwise categorically excluded will not have a significant effect on the human environment, and for which an EIS will not be prepared. 40 CFR 1508.13

After discussions with the Hawaii Office of Environmental Quality and an initial assessment of local permitting procedures, Mr. Lorenzi advised the project in January 1999 that it probably would not qualify for a categorical exclusion and would be subject to an Environmental Assessment (EA). Mr. Lorenzi later said that the project did not receive a categorical exclusion for two reasons. First, the experiment was to take place in

the ocean near a marine sanctuary for humpback whales. Any projects dealing with the ocean will raise eyebrows, and environmental issues were very important to the Clinton administration. Second, DOE wanted to allay the fears of concerned citizens. If a project does not qualify for a categorical exclusion, it is required to undergo a federal Environmental Assessment (EA) or Environmental Impact Statement (EIS). The project team had anticipated that the categorical exclusion would be approved. As a result, the start of the experiment would now be delayed from the summer of 2000 to summer of 2001, and the project would exhaust resources to draft the necessary permit documents.

In October 1999, a public scoping meeting was held at a local school in Kona. The meeting fulfilled part of the public meeting requirements of the NEPA process. Representatives from the project's Technical Committee, DOE, and PICHTR made presentations to an audience of about 30 people. The meeting was the project team's first formal presentation to the public. The presenters explained the motivations for the field experiment and the process by which Hawaii was chosen to host the event. An informal question/answer session was held following the presentations, where members of the project team responded to specific questions from the public. The project team intended the meeting to establish a dialogue between the project team and the public. While it was successful in bringing stakeholders to a common location to discuss the project, there was not much progress made in resolving their differences.

On August 8, 2000, DOE released a draft EA of the field experiment for public review and comment. Although PICHTR did much of the work in writing the assessment, NETL was the official author and thus had the final say in what was included and how it was stated. The EA outlined potential environmental consequences of the

experiment at various locations, and tentatively did not see the ocean environment being significantly impacted by the experiment. The EA also responded to some of the concerns that the public had made regarding the project, such as religious and cultural impacts. During the comment period, the project received about 200 different comments from the public in response to the assessment.

DOE issued a final EA eight months later in April 2001, followed by a Finding of No Significant Impact (FONSI) in May 2001. DOE said that although the project was no longer located at NELHA's Keahole Point facility, this did not affect the validity of the EA's analyses of the potential consequences from conducting the proposed experiment at any of the three alternative sites in Hawaii it prescribed. Therefore, no additional changes would be needed for the project's decision making in terms of an EA as long as a location was chosen as prescribed in the FONSI.

The FONSI was contingent on several mitigation measures and recommendations intended to further reduce perceived uncertainties and public concerns about the field experiment. The experiment was to be conducted away from prime fishing grounds (i.e. not in the Keahole area). The lead marine biologist, Craig Smith, was to be given authority to stop the project if, in his professional opinion, CO₂ release was harming marine life. The experimental plan was to be submitted to a group of outside experts for review. The FONSI called for a limited CO₂ deployment schedule for the experiment.

8.2 Positions

Project Team

The project team wanted to satisfy the concerns of the public, while still moving ahead with speed. The scientists were interested in receiving a categorical exclusion, however the part of DOE responsible for permitting decided that it would not be possible, partially due to the public nature of the concerns. The project team felt that the Environmental Assessment was a comprehensive document, but that an Environmental Impact Statement would not be needed because the project posed no significant impact.

The FONSI stated that the project could not be located in an area such as Keahole Point and therefore the project team would need to relocate the experiment. The team had already planned to find an alternate location anyway. If the project chose to stay in Hawaii, it would have two options. One would be to locate itself outside of state jurisdiction, but within federal waters. In this scenario, the project would be subject to EPA jurisdiction under the Ocean Dumping Act. The process for obtaining a dumping permit is separate from the process for designating a dumping site. Public hearings would be required for both. If the project chose to locate itself within state waters, it would be subject to state environmental discharge requirements under the Clean Water Act, with the requirements being administered by the Hawaii Department of Health with EPA oversight.

Opposition

The opposition was opposed to the project occurring at all. If an environmental analysis had to be undertaken, however, the opposition felt that an EIS would be

necessary and not an EA. The opposition thought that the assessment was “incomplete and did not address the impacts of pouring liquid carbon dioxide into one of West Hawaii’s primary cultural and economic assets.”⁸⁰ Jay Scharf, spokesman for the Coalition Against CO₂ Dumping, said that he would like to see a baseline biological study with an inventory of existing conditions and life.⁸¹ The opposition’s chief criticism of the project was that it did not take biological impacts into account, and even when it tried to address biology, the EA was not thorough. Scharf said that the Coalition would be prepared to go to the courts to stop the experiment.⁸² Those opposing the project were glad that the project was being moved elsewhere, but remained unconvinced that the experiment posed no significant impact to the marine biology.

8.3 Result of Battle

The result of the permitting battle was a draw. The project team lost its battle for a categorical exclusion and the opposition lost its battle for an Environmental Impact Statement. The Environmental Assessment provided a middle ground. Of course, the delays in the project meant that the battle was an important step in the larger war for the opposition.

⁸⁰ B. Command, “No Federal Decision on CO₂ Tests,” *West Hawaii Today* [Internet], April 26, 2001 [cited May 8, 2002]. Available from: <http://www.westhawaii.com/daily/2001/Apr-26-Thu-2001/news/news1.html>.

⁸¹ Ibid.

⁸² Ibid.

8.4 Commentary

The permitting battle resulted in some of the most heated exchanges between the opposition and the project team. Elements of xenophobia were exposed—some members of the opposition expressed distrust with international scientists on the project team, telling them to go back home and pollute their own waters. It also appeared that there was particular distrust of the strong Japanese funding.

The FONSI required the project to increase the authority of biologists on the Technical Committee. The Technical Committee had felt that biology was not a key element to the project because the release was too small to cause a biological impact. The committee complied with the request.

The project team was forced to spend a five-figure amount in the development of the Environmental Assessment. Given that the budget was so small to begin with, this was a non-significant amount of money. While the battle did not kill the project, it did drain resources and cause delays.

The battle raises some interesting questions in dealing with permitting and opposition. First, is the best opposition to a small project “bleeding it to death”? The project team was not able to fight all its battles because it did not have the resources to do so. Even when it did fight the battles, its resources were limited.

Second, must any experiment, no matter how small, have the ability to be prepared for an extended permitting process? In private, even members of the opposition have admitted that the project would not pose a significant environmental impact, yet the project team was forced into a drawn-out permitting process. Why even go through permitting at all? Sometimes projects have decided not to open themselves up to the

public, choosing to release information about the experiment only after the project was completed.

PART IV: Analysis

“It’s a familiar axiom in politics—and one well-known by top Red Sox consultant John Sasso, who managed Michael Dukakis’s 1988 presidential campaign—that if a candidate doesn’t define himself for voters, his opponent will, and not in flattering terms.”

- Anthony Flint, *Boston Globe* staff, on the opposition of building a new Fenway Park for the Boston Red Sox⁸³

9. Take Away Points

9.1 *The project was a lightning rod*

Even when some of the opposition leaders are asked about the project, they admit that the field experiment would be environmentally benign. Why then did the discourse become so heated? A major reason was that the experiment had several elements that attract passionate discourse, especially in Hawaii.

First, the site for this experiment was not just any lab—it was the *ocean*. The people of Hawaii feel very passionately about their waters. For some, the reason is economic. The fishing industry is a large component of the Kona economy. It also includes a tourism component, with people coming to Kona specifically to go deep sea fishing for its marlins. Some in the fishing community thought that the injected carbon dioxide might adversely affect the marine life at Keahole Point. Another reason the ocean can be of concern is the Hawaiian culture. Some native Hawaiians feel that outsiders tampering with the ocean are committing acts of sacrilege.

Second, carbon sequestration is viewed by some environmentalists as a way of perpetuating the use of *fossil fuels*. Some opponents to the project felt that money would

⁸³ A. Flint, “Team Took Steps to Control Debate over its Plans,” *The Boston Globe* (City Edition): May 16, 1999, p. A1.

be much better spent on energy efficiency, renewable energy options, and conversion to a hydrogen economy. Proponents of sequestration argue that it is part of a greater portfolio of options, and that conversion to a hydrogen economy cannot occur overnight.

Proponents argue that carbon sequestration might ease the transition from fossil fuels to hydrogen by providing a smooth pathway from one to the other.

Third, the project exposed elements of *xenophobia* on the part of some Hawaii residents. The town of Kona used to be a small agricultural town. As the development craze hit the Big Island of Hawaii, developers (many from Japan) transformed Kona into a resort community. Some residents believe that outsiders have a track record of destroying their community, and were thus wary of the international nature of the experiment. In letters to the project and in the press, sequestration scientists were compared to Hitler's scientists.⁸⁴ The carbon dioxide experiment was being compared to experiments of Agent Orange on Army soldiers.⁸⁵ One scientist, who had made Hawaii his home for a number of years, was told to go back to his home country and pollute his own waters. Correspondence with expletives was sent to the project team, one even coming from the local representative to the Hawaii State Legislature.⁸⁶

9.2 Pay attention to local benefits

With all the emotionally charged issues surrounding the experiment, Hawaii was probably not the best place to host the project. Some have characterized Kona as the

⁸⁴ See Lambeth, Note 59.

⁸⁵ "In the 1950's, Donald Cataluna took a summer job at the University of Hawaii to test new chemicals being developed by the U.S. Army to kill brush...years later with Vietnam, that chemical was known as Agent Orange...but nobody knew right? ...Nobody really knows (the long-term effects) and it may be some adverse think like Esteron 10-10 becoming Agent Orange..." – *Donald Cataluna (Trustee, Office of Hawaiian Affairs) and Pat Omandam (reporter) in Honolulu Star Bulletin, July 10, 2001*

⁸⁶ A copy of the legislator's letter can be found in Appendix H.

“Berkeley of the Pacific.” It is a place where environmental and native Hawaiian groups hold a lot of power, and people mobilize around issues very quickly.

In addition, the residents of Kona perceived no benefits from the project, but saw many potential risks. One might have thought that problems associated with climate change, such as sea level rise, would have been particularly salient issues for residents of Hawaii, but this was not so. Residents of Hawaii saw no benefits being derived from the project. In fact, they perceived a myriad of problems, such as harm to marine life and potential economic disruptions.

This is representative of one of the problems that governments have dealing with climate change. Climate change is a global problem and can only be addressed if individual countries take steps towards climate change mitigation. The costs are concentrated, however, the benefits are diffuse. And given the long-term nature of the problem, it is hard to stimulate action. In retrospect, some members of the project team have suggested that the project might have been better served at a location where there might be benefits deriving from the project (e.g. where permanent sequestration might take place), or an area more concerned with the climate change problem and receptive to carbon sequestration as a pathway to a solution.

9.3 If you want to make a splash, you better have enough resources

From the very beginning of the project, the sponsors intended to make the experiment into something of a public spectacle. They decided to sign the project agreement at the COP-3 meeting in Kyoto, the most visible place one could sign an agreement for a climate change experiment. Unfortunately, the project team was not

given enough resources to deal with the public. It was forced to pick and choose its battles; investing resources in public outreach would be at the expense of the science in the project. The battles that the project team chose to fight, it won. The project team was not able to fight every battle, and as a result it lost the war.⁸⁷

One can debate the merits of going public versus not going public. The fact of the matter, however, is that since the project decided to go public, it needed to commit to putting resources behind its decision.

9.4 The public can become fearful when a new technology is not explained and skeptical when it appears the public has been excluded from decision-making process⁸⁸

While going public can open a project up to criticism from the public, there can also be problems resulting from staying silent. By the time the project team had its first meeting, the public had already been “educated” about carbon sequestration by the opposition.

Often times, what one perceives about a technology is based on one’s first encounter. Many residents of Hawaii did not understand the nature of the carbon cycle—that much of the carbon dioxide currently being emitted worldwide will enter the ocean. In fact, some residents drove around with “Stop CO₂ Dumping” bumper stickers, with the bumper sticker placed squarely above the vehicle’s tailpipe!⁸⁹ Some members of the public thought that the entire Keahole ecosystem could be destroyed by the experiment,

⁸⁷ The project team’s definition of success, however, depends on whom you ask—a point that will be expanded upon later in this chapter.

⁸⁸ This idea is derived from M. Sun, “Local Opposition Halts Biotechnology Test,” *Science* 231 (February 14, 1986), pp. 667-668.

⁸⁹ B. De Lollis, “Ocean Injection Explored as a Way to Hide CO₂ Dumping,” *Gannett News Service: ARC*, July 13, 2001.

when in fact even Coalition leaders admit that no catastrophe could possibly have happened.⁹⁰ Residents were also of the mindset that had the experiment not been dangerous, then the scientists would have told the public earlier. They thought that the project team must have been hiding something.

If one intends to go public, it should occur at the beginning of the process. If the opposition is able to reach the public first, it will be able to shape the debate on its own terms. Projects in the public eye need to conduct research in a transparent fashion while engaging in appropriate public outreach. Of course, a project can choose not to go public. While there is a chance that such a project could have a “successful” outcome, one should take notice that if the public learns of the project and finds out that scientists tried to hide the experiment from the public, the project will probably face an even bigger opposition than if it had gone public at the beginning.

⁹⁰ Adams, See Note 23 and R. Wilder, personal communication (February 15, 2002), President, The Hydrogen Fuel Cell Institute, 21 Hale Makai Place, Lahaina, HI 96761, Tel: 808-669-2773, Email: rob@h2fuelcells.org.

10. Concluding Remarks

The Hawaii CO₂ field experiment was not the first incident where an opposition was able to successfully mobilize against a project—and it certainly will not be the last. Scientists will need to learn from the experiences of each other. For example, public opposition in the infancy of biotechnology very much paralleled the public opposition seen in the field experiment.⁹¹ The future work of scientists, especially in sensitive areas such as climate change, will need to be modified. Scientists have traditionally been used to designing experiments within the confines of their own laboratory, submitting the results to a peer review process, and only then presenting the experiment to the public. As we have seen with the Hawaii experiment, the public is demanding for scientists to present experiments to the public first, and only then can they move forward with the research. Coupled with informational advances that allow the public to mobilize much faster and more globally than ever before, scientists will need to get used to this new way of doing business.

⁹¹ M. Sun, “Local Opposition Halts Biotechnology Test,” *Science* 231 (February 14, 1986), pp. 667-668.

PART V: Epilogue

What has saddened me most during this process, and we are partly responsible, is the lack of science and quantifiable information. I think the public has not been served well the way this dialogue has been manipulated... the public has not learned much valuable information.”

- Gerard Nihous, *PICHTR*⁹²

As instructed by the Finding Of No Significant Impact in May 2001, PICHTR began to search for a new project site. The project sponsors hoped to conduct the carbon dioxide experiment in 2002, and beginning in August 2001, examined several contingency plans for hosting sequestration experiments in their own countries.

DOE took steps to conduct the field experiment off Nawiliwili in Kauai. The proposed location was an EPA-designated ocean dredged material disposal site that had the correct depth for the experiment. In fact, it was the only site at the proper depth in United States territorial waters. On March 14, 2002, EPA announced that the project had requested a research permit to conduct an experiment in Kauai and that EPA would not issue a research permit until it was determined that the activities were in compliance with the Coastal Zone Management Act, the Endangered Species Act, and the Essential Fish Habitat Act.⁹³ A 90-day public comment period was established in which the public could comment on EPA's tentative determination to issue a Research Ocean Dumping Permit to dispose of no more than 20 tonnes of carbon dioxide over a period of not more than 14 days. The permit would expire 18 months after issuance. The project team again

⁹² J. Kelly and G. Kelly, “An Update: Choosing Sides on the CO₂ Ocean Sequestration Proposal,” *Hawaii Island Journal*, May 16-31, 2001, pp. 11-13

⁹³ U.S. Environmental Protection Agency [Internet], San Francisco (CA): EPA Is Requested to Issue Ocean Research Permit for Carbon Dioxide Test Off Kauai; [updated March 14, 2002; cited May 8, 2002].

Available from:

<http://yosemite.epa.gov/r9/r9press.nsf/7f3f954af9cce39b882563fd0063a09c/bca3e0702b6d57a688256b7c0075f7e0?OpenDocument>.

faced a mobilized opposition that included many of the same members as Kona. On June 27 2002, the project team announced that it would be withdrawing its EPA application due to the “excessive time” it was taking to secure a permit.⁹⁴

Concurrently, NRC proposed locating the experiment in Norway in the summer of 2002. In January 2002, the team was able to obtain an experimental permit from the Norwegian Pollution Control Authority (known by its Norwegian acronym, “SFT”) within a matter of days of applying. About a month before the experiment was slated to begin in July 2002, Greenpeace and the World Wildlife Fund (WWF) expressed concerns to the Norwegian government about the experiment. In particular, Greenpeace argued that the experiment was in violation of the OSPAR convention, a treaty that regulates ocean dumping in the northeast Atlantic Ocean. Ocean carbon sequestration has not been addressed by OSPAR, but is slated to be discussed at the OSPAR June 2003 meeting. SFT conducted public hearings in response to the complaints, evaluated the opposition’s concerns, and on July 5, 2002 decided to reissue its permit.

Greenpeace and WWF continued to put pressure on the Norwegian government. The tension was brought to a high point when Greenpeace sent one of its Rainbow Warrior ships to Norway to meet with environmental officials and draw attention to the project. On August 22, 2002, Norway’s Environmental Minister Børge Brende overruled SFT and vetoed the project, stating “the use of deep marine areas as possible future storage places for CO₂ should first be thoroughly discussed internationally and the legal implications clarified.”⁹⁵

⁹⁴ V. Gewin, “Ocean Carbon Study to Quit Hawaii,” *Nature* 418 (June 27, 2002), p. 888.

⁹⁵ Norway Ministry of the Environment [Internet], Oslo (Norway): *Release of CO₂ in the Norwegian Sea May Be in Conflict with International Environmental Conventions* [updated August 22, 2002; cited

It is unclear what the next steps for the experiment will be. While it may be legal to conduct the project in international waters, most are too deep for the experiment. In addition, the permitting problems from Kauai and Norway wasted additional time and resources. The project team is evaluating its options.

APPENDIX

Appendix A: Project Agreement

Project Agreement for International Collaboration on CO₂ Ocean Sequestration

Source: U.S. Department of Energy, "Appendix A," *Environmental Assessment – Ocean Sequestration CO₂ Field Experiment*, Report No. DOE/EA-1336, pp. A-1–A-6.

***PROJECT AGREEMENT FOR INTERNATIONAL COLLABORATION ON CO₂
OCEAN SEQUESTRATION***

This Project Agreement is entered into among the Federal Energy Technology Center (FETC) of the Department of Energy of the United States of America, the New Energy and Industrial Technology Development Corporation (NEDO) and the Research Council of Norway (NRC) (collectively the “Parties”).

WHEREAS, in 1995 member countries of the International Energy Agency and the Organization for Economic Cooperation and Development created the Climate Technology Initiative (CTI);

WHEREAS, the CTI seeks to support the objectives of the United Nations Framework Convention on Climate Change by increasing the use of existing climate-friendly technologies and developing new and improved climate-friendly technologies through the promotion of international cooperation in research, development, deployment and information dissemination;

WHEREAS, an objective of CTI’s Task Force 7 is to enhance international collaboration in research and development in greenhouse gas capture and disposal, including research on ocean sequestration of CO₂; and

WHEREAS, the CTI’s Task Force 7 invites the Parties to explore on an international collaborative basis the technical feasibility and environmental impact of CO₂ ocean sequestration, in order to advance current knowledge of the behavior of discharged CO₂ in the ocean.

NOW THEREFORE, the Parties agree as follows:

**Article 1
Objective of the Project**

The objective of the international collaboration on CO₂ ocean sequestration (the “Project”) is to determine the technical feasibility of, and improve understanding of the environmental impacts of, CO₂ ocean sequestration in order to minimize the impacts associated with the eventual use of this technique to reduce greenhouse gas concentrations in the atmosphere.

**Article 2
Scope of Work**

To advance current knowledge of the behavior of discharged CO₂ in the ocean, joint research shall be undertaken which mainly focuses on dissolution-type CO₂ discharge

experiments conducted at an ocean site. In this joint research, a CO₂ injection system will be constructed and operated to observe near-field phenomena such as droplet plume dynamics and subsequent peeling and intrusion of enriched water. This joint research shall be conducted within the estimated cost of the Project as described in Article 9.

Article 3 Work Program

The program of work for the Project (hereinafter the “Work Program”) shall be as follows:

1. Selection of the most suitable site for ocean field experiments.
2. Determination of the discharge depth, rate, timing and duration of experiments.
3. Design of facilities for CO₂ storage, transport and discharge.
4. Selection of the items to be measured and monitored in experiments.
5. Preparation and testing of equipment for measurement and monitoring.
6. Construction of CO₂ storage, transport and discharge facilities.
7. Carrying out of ocean field experiments.
8. Analysis of data acquired during experiments.
9. Collation of overall results obtained in the field experiments.
10. Formulation of a proposal for the next phase of the Project.
11. Other activities as may be mutually agreed by the Parties in writing.

All Parties shall cooperate with one another to promote the Work Program.

Article 4 Addition and Withdrawal of Project Participants

- (1) Upon approval of the Steering Committee (described in Article 6), participation in the Project shall be open to other organizations which sign or accede to this Project Agreement, accept the rights and obligations of a Party, and make an appropriate contribution to defray the cost of the Project.
- (2) In the event a Party wishes to withdraw from the Project for budgetary or other reasons, it may do so at the end of a fiscal year (as defined in Article 8) upon sixty (60) days’ written notice to the other Parties.

Article 5 Implementing Research Organizations

- (1) Each Party may implement Project activities through an appropriate domestic research organization (hereinafter “Implementing Research Organization”). Alternatively, a Party may undertake Project activities itself.

(2) The Parties' designated Implementing Research Organizations are as follows:

For FETC:

Massachusetts Institute of Technology (United States of America)

For NEDO:

Research Institute of Innovative Technology for the Earth (Japan)

For NRC:

Norwegian Institute for Water Research (Norway)

- (3) The Parties shall support their respective Implementing Research Organizations by providing annual funding to be used for implementing the Project, subject to Article 9.
- (4) In order to establish work responsibility, details regarding treatment of intellectual property, and necessary policy and procedure for the Project, the Implementing Research Organizations shall conclude an annual joint research agreement for each fiscal year of the Project.

Article 6 Steering Committee

- (1) A committee consisting of one representative of each Party (hereinafter "Steering Committee") shall be established to manage the overall direction and scope of the Project and to consider and approve the participation of other organizations in the Project.
- (2) The Steering Committee shall be responsible for resolving any misunderstandings or problems related to this Project Agreement or the Project based on the principles of mutual benefit, equality, cooperation and trust.
- (3) The Steering Committee shall hold its first meeting within one (1) month of the execution of this Project Agreement to establish duties, policies and procedures for implementing the Project. Following its first meeting, the Steering Committee shall meet approximately once a year at a place mutually agreed by all members.

Article 7 Technical Committee

- (1) The Parties shall establish a Technical Committee consisting of up to three (3) representatives appointed by each Implementing Research Organization, to formulate the annual Work Program for each year of the Project, to supervise its technical

aspects and execution, and to consult about treatment of intellectual property.

- (2) The Technical Committee shall also be responsible for managing the budget for implementing the Work Program and coordinating any optional research studies which may be undertaken during the Project.
- (3) The Technical Committee shall report to the Steering Committee at least twice a year regarding implementation of the annual Work Program for the Project.
- (4) The specific functions of the Technical Committee shall be set forth in the annual joint research agreements among the Implementing Research Organizations.

Article 8 Project Fiscal Year

The Parties agree that the fiscal year of the Project shall extend from April 1st to March 31st of the following year.

Article 9 Cost Contributions

The total estimated cost of the Project is Three Million Eight Hundred Thousand U.S. Dollars (U.S.\$3,800,000). Subject to the availability of appropriated funds and appropriate authorizations by their respective governments, the Parties agree to share the cost of the Project as follows:

Agency Funding Level (U.S.\$) Percentage of Funding
--

FETC \$850,000 22.4%

NEDO \$2,600,000 68.4%

NRC \$350,000 9.2%

Article 10
Treatment of Project Results

Basic policy regarding the use and protection of research data and intellectual property resulting from Project activities shall be determined through mutual discussion and agreement of the Parties. Specific details concerning the treatment of project results shall be included in the annual joint research agreements provided for under Article 5.

Article 11
Waiver of Claims for Damages

In the event of any material damage or loss of life due to an accident or any reason other than willful misconduct or gross negligence during the implementation of the Project, no compensation shall be claimed by any Party against any other Party or against the Implementing Research Organizations.

Article 12
Amendment of this Agreement

In the event the Steering Committee determines that it is necessary to amend this Project Agreement, it may be amended by written agreement of the Parties.

Article 13
Mutual Trust and Cooperation

- (1) Each Party shall endeavor, in the spirit of mutual trust, to resolve any difficulties or misunderstandings which might arise concerning the Project or this Project Agreement.
- (2) Each Party shall conduct the collaboration under this Project Agreement in accordance with the applicable laws and regulations under which each Party operates.
- (3) Any questions arising in connection with the interpretation or implementation of this Project Agreement or anything not specified herein shall be promptly discussed through mutual consultation among the Parties.

Article 14
Responsibility for and Use of Information

- (1) The Parties support the widest possible dissemination of information generated by Project activities. Such information may be made available for public dissemination at the discretion of the Parties, subject to the need to protect proprietary information

in accordance with Article 14(2).

- (2) The Parties shall take all necessary measures as they may consider appropriate to protect proprietary information. For the purposes of this Article, proprietary information shall include information of a confidential nature such as trade secrets and know-how (for example, computer programs, design procedures and techniques, chemical composition of materials, or manufacturing methods, processes or treatments) which:
- (i) is not generally known or publicly available from other sources;
 - (ii) has not previously be made available by the owner to others without obligation concerning its confidentiality; and
 - (iii) is not already in the possession of the recipient without obligation concerning its confidentiality.

It shall be the responsibility of each Party supplying proprietary information to identify the information as such and to ensure that it is marked "Proprietary Information".

- (3) Information transmitted by one Party to another Party shall be accurate to the best knowledge and belief of the transmitting Party, but the transmitting Party does not warrant the suitability of the information transmitted for any particular use or application.

Article 15 **Effective Date, Extension, and Termination**

- (1) This Project Agreement shall be effective from the date of its signing by all Parties through March 31, 2002, unless extended or terminated.
- (2) By mutual written agreement, the Parties may extend this Project Agreement for additional periods.
- (3) The Parties may by mutual written agreement terminate this Project Agreement at any time.

IN WITNESS WHEREOF, each Party has executed this Project Agreement on the date indicated with each Party to retain one (1) fully executed copy.

**Federal Energy Technology Center
Department of Energy
United States of America**

Signature:

Name: Harvey M. Ness

Title: Director, Power and Environmental Systems

Date: December 4, 1997

**New Energy and Industrial Technology Development Organization
Japan**

Signature:

Name: Hiroshi Mitsukawa

Title: Executive Director

Date: December 4, 1997

**Research Council of Norway
Norway**

Signature:

Name: Eirik Normann

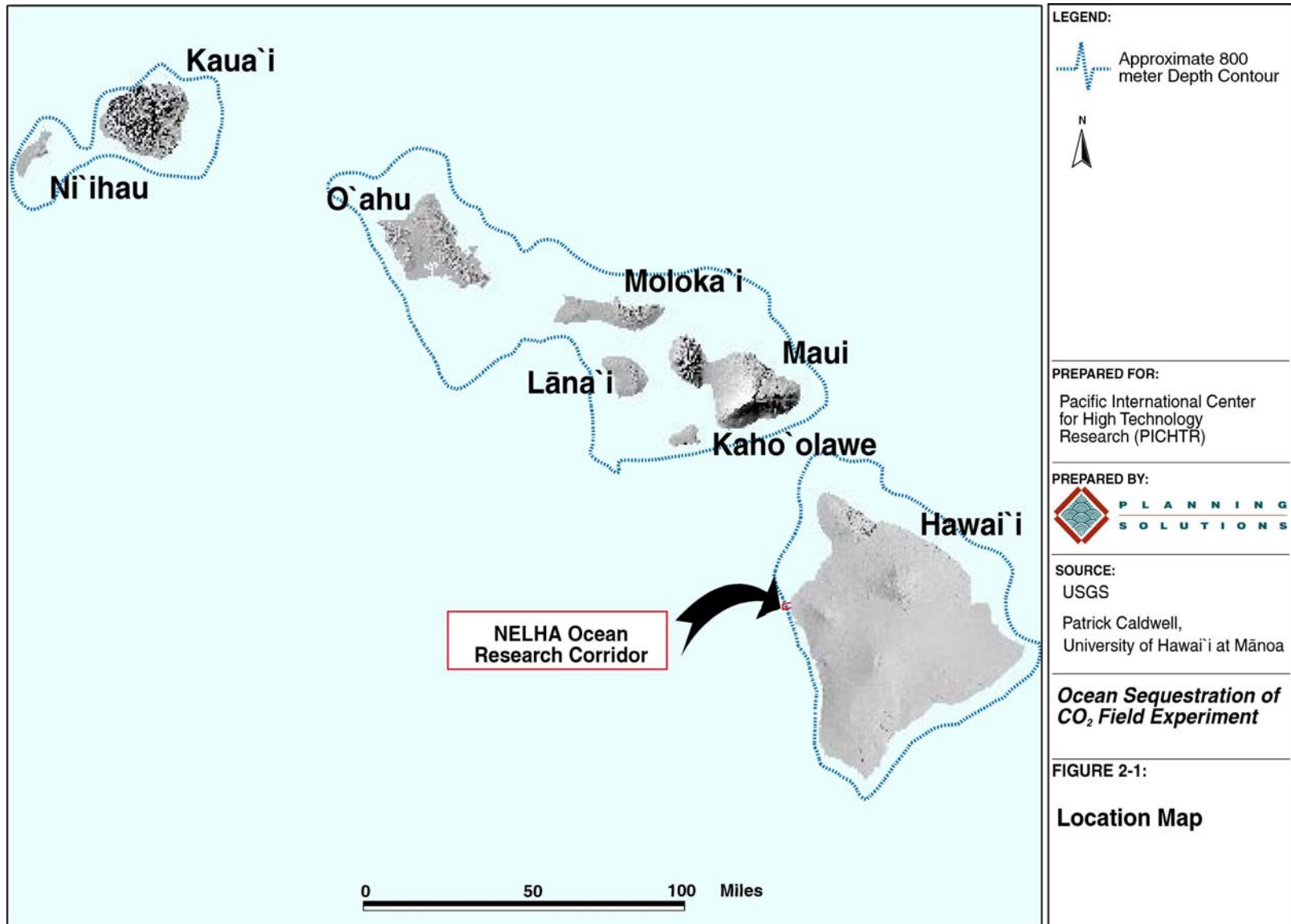
Title: Assistant Director

Date: December 4, 1997

Appendix B: Location Map

Location Map, Prepared by Planning Solutions

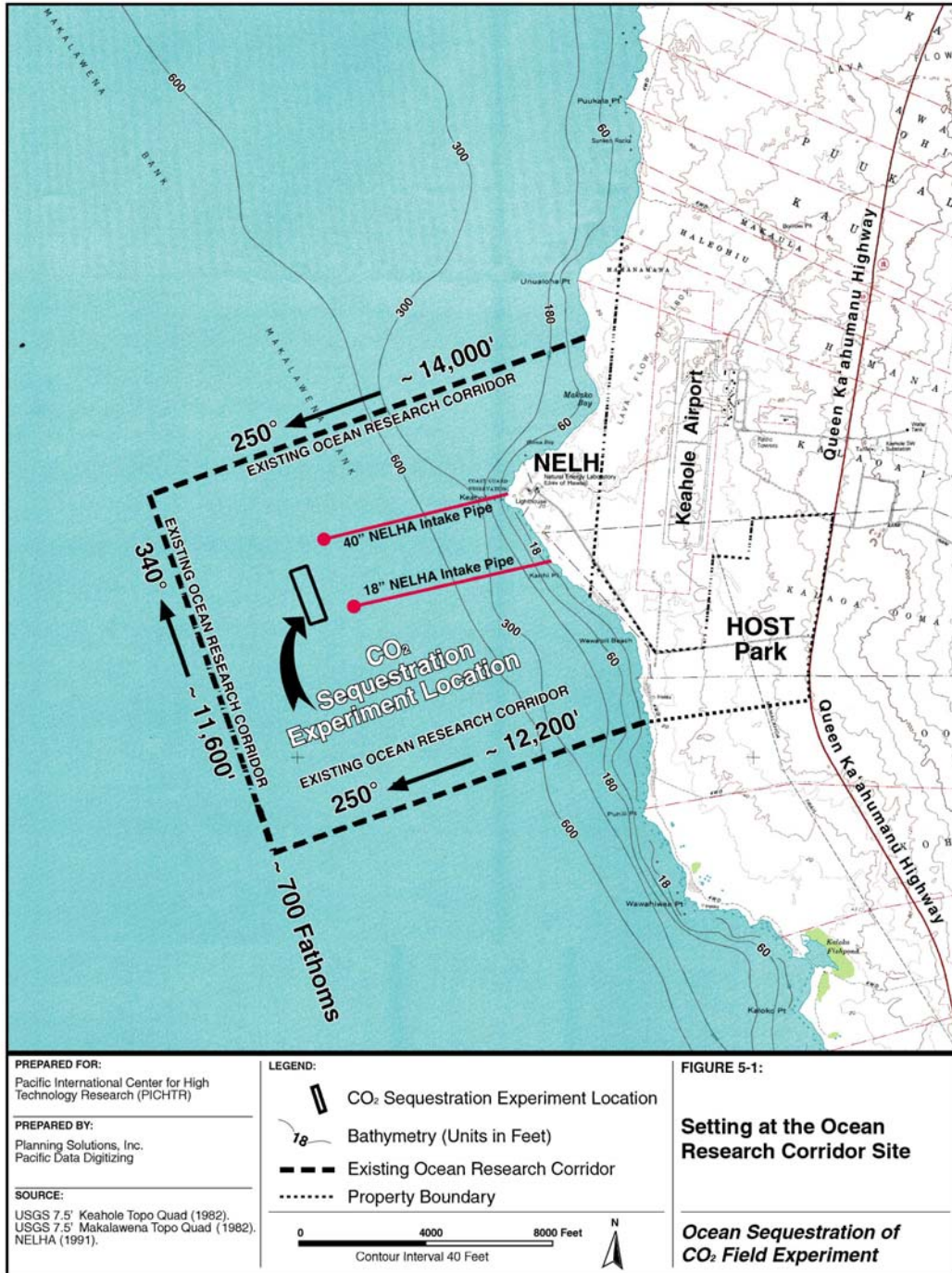
Source: U.S. Department of Energy, "Appendix A," *Environmental Assessment – Ocean Sequestration CO₂ Field Experiment*, Report No. DOE/EA-1336, p. 2-2.



Appendix C: Research Corridor

Setting at the Research Corridor Site, Prepared by Planning Solutions

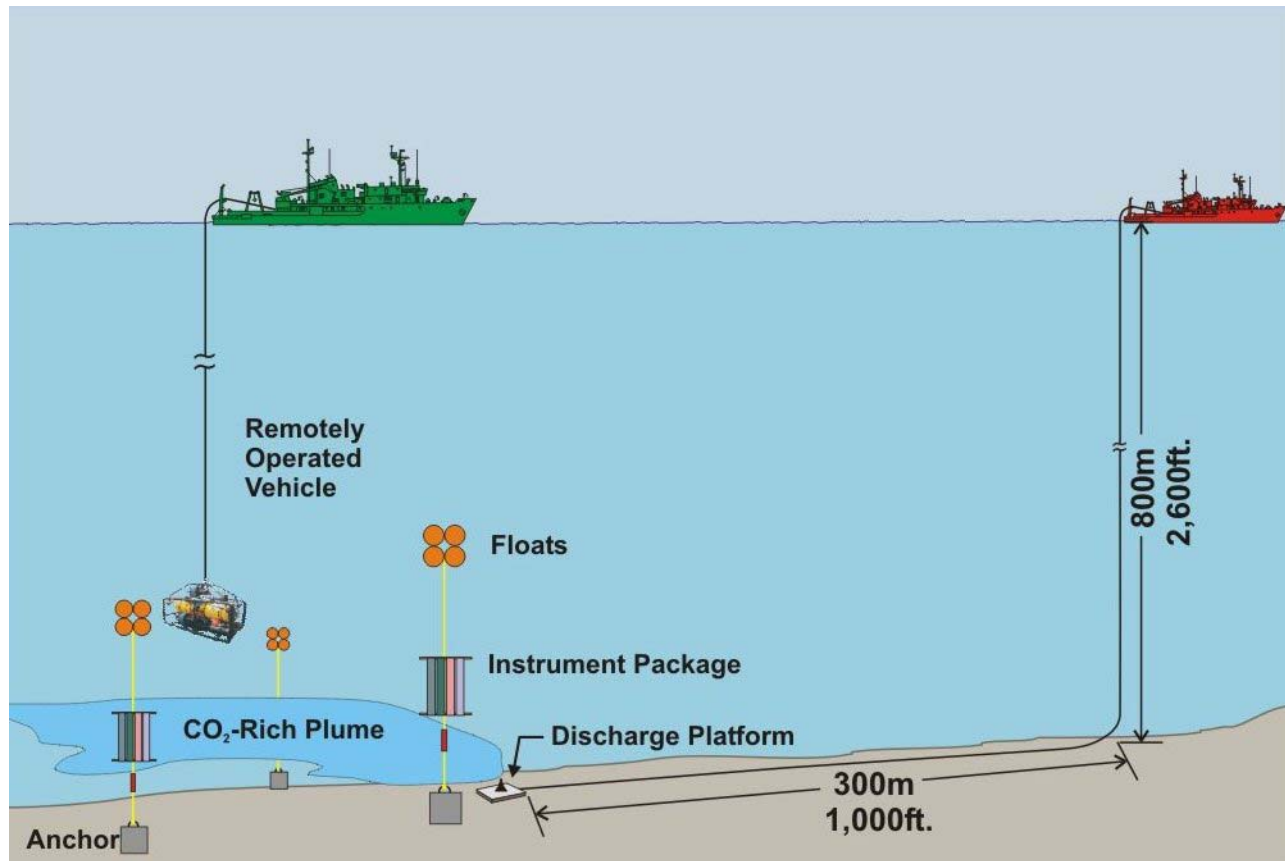
Source: U.S. Department of Energy, "Appendix A," *Environmental Assessment – Ocean Sequestration CO₂ Field Experiment*, Report No. DOE/EA-1336, p. 5-2.



Appendix D: Experimental Methods

General Methods Used in the Field Experiment, Prepared by Planning Solutions

Source: U.S. Department of Energy, "Appendix A," *Environmental Assessment – Ocean Sequestration CO₂ Field Experiment*, Report No. DOE/EA-1336, p. 4-11.



Appendix E: Army Permit

Permission from the Department of the Army

Source: E. Adams and H. Herzog, "Site Selection Study for an Ocean CO₂ Disposal Field Experiment," prepared for *Research Institute for Innovative Technology for Earth*, February 1998, pp.H-26–H -34.

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTED HAWAII 96858-5440

REPLY TO
ATTENTION OF

Operations Branch

September 24, 1997

Dr. Thomas H. Daniel
Scientific/Technical Director
Natural Energy Laboratory of Hawaii Authority
73-4460 Queen Kaahumanu Highway, # 101
Kailua-Kona, Hawaii 96740

Dear Dr. Daniel:

This is in response to NELHA's September 17, 1997 request on the behalf of Pacific International Center for High Technology et al. for Department of the Army (DA) permit authorization for work in navigable waters of the United States associated with the proposed Carbon Dioxide Sequestration experiment at Keahole Point, County and State of Hawaii.

Based on the information provided, we have determined that the proposed work can be authorized by the Corps Nationwide permit (NWP) authority (December 13, 1996 Federal Register, Final Notice of Issuance, Reissuance, and Modification of Nationwide Permits, 61 FR 65874) NWP #5 (Scientific Measurement Devices) and no further Department of the Army processing is necessary.

This authorization remains valid for two years or until NWP #5 is modified, reissued, or revoked. Please note that if you commence, or are under contract to commence the proposed activity before the date that NWP #5 is modified or revoked, you will have twelve months from the date of the modification or revocation to complete the activity under the existing terms and conditions.

Enclosed are excerpts from the regulations, which include the conditions of the NWPs for your information and compliance. Please note that NWP Condition #14 requires applicants to submit a compliance certification upon completion of the project. A certification is enclosed for your use.

File Number 970000344 has been assigned to this project. Please refer to this number in any future correspondence regarding the project. If you have any questions, please call Ms. Kathleen Dadey of my staff at 438-9258, extension 15.

Sincerely,

Linda M. Hihara-Endo, Ph.D., P.E.
Acting Chief, Operations Branch

Enclosures

Copies Furnished (without enclosures):

Office of Planning, CZM Program Office, Honolulu, HI
Department of Land and Natural Resources, Honolulu, HI
U.S. Coast Guard (oan), Honolulu, HI
U.S. Fish and Wildlife Service, Honolulu, HI
National Marine Fisheries Service, Honolulu, HI
Planning Department, County of Hawaii, Hilo, HI

NATIONWIDE PERMIT CONDITIONS

GENERAL CONDITIONS:

The following general conditions must be followed in order for any authorization by a NWP to be valid:

1. Navigation: No activity may cause more than a minimal adverse effect on navigation.
2. Proper maintenance: Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.
3. Erosion and siltation controls: Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date.
4. Aquatic life movements: No activity may substantially disrupt the movement of those species of aquatic life indigenous to the waterbody, including those species which normally migrate through the area, unless the activity's primary purpose is to impound water.
5. Equipment: Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.
6. Regional and case-by-case conditions: The activity must comply with any regional conditions which may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state or tribe in its section 401 water quality certification.
7. Wild and Scenic Rivers: No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service.)
8. Tribal rights: No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.
9. Water quality certification: In certain states, an individual Section 401 water quality certification must be obtained or waived (see 33 CFR 330.4(c)).
10. Coastal zone management: In certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see Section 330.4(d)).

11. Endangered Species:

(a) No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act, or which is likely to destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the District Engineer if any listed species or critical habitat might be affected or is in the vicinity of the project, and shall not begin work on the activity until notified by the District Engineer that the requirements of the Endangered Species Act have been satisfied and that the activity is authorized.

(b) Authorization of an activity by a nationwide permit does not authorize the take of Species Act. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with incidental take provisions, etc.) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, both lethal and non-lethal takes of protected species are in violation of the Endangered Species Act. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. Fish and Wildlife and National Marine Fisheries Service or their world wide web pages at <http://www.fws.gov/~r9endspp/endspp.html> and http://kingfish.spp.mnfs.gov/tmcintyr/prot_res.html#ES and Recovery, respectively.

12. Historic properties: No activity which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places is authorized, until the DE has complied with the provisions of 33 CFR Part 325, Appendix C. The prospective permittee must notify the District Engineer if the authorized activity may affect any historic properties listed, determined to be eligible, or which the prospective permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin the activity until notified by the District Engineer that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the State Historic Preservation Office and the National Register of Historic Places (see 33 CFR 330.4(g)).

13. Notification.

(a) Timing: Where required by the terms of the NWP the prospective permittee must notify the District Engineer with a Pre-Construction Notification (PCN) as early as possible and shall not begin the activity:

(1) Until notified by the District Engineer that the activity may proceed under the NWP with any special conditions imposed by the District or Division Engineer; or

(2) If notified by the District or Division Engineer that an individual permit is required; or

(3) Unless 30 days (or 45 days for NWP 26 only) have passed from the District Engineer's receipt of the notification and the prospective permittee has not received notice from the District or Division Engineer.

Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Notification: The notification must be in writing and include the following information:

- (1) Name, address and telephone numbers of the prospective permittee;
- (2) Location of the proposed project;
- (3) Brief description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause; any other NWP(s), regional general permit(s) or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity; and
- (4) For NWPs 14, 18, 21, 26, 29, 34, and 38, the PCN must also include a delineation of affected special aquatic sites, including wetlands (see paragraph 13(f));
- (5) For NWP 21: Surface Coal Mining Activities, the PCN must include an OSM or state approved mitigation plan.
- (6) For NWP 29-Single-Family Housing, the PCN must also include:
 - (i) Any past use of this NWP by the individual permittee and/or the permittee's spouse;
 - (ii) A statement that the single-family housing activity is for a personal residence of the permittee;
 - (iii) A description of the entire parcel, including its size, and a delineation of wetlands. For the purpose of this NWP, parcels of land measuring 0.5 acre or less will not require a formal on-site delineation. However, the applicant shall provide an indication of where the wetlands are and the amount of wetlands that exists on the property. For parcels greater than 0.5 acre in size, a formal wetland delineation must be prepared in accordance with the current method required by the Corps. (See paragraph 13(f));
 - (iv) A written description of all land (including, if available, legal descriptions) owned by the prospective permittee and/or the prospective permittee's spouse, within a one mile radius of the parcel, in any form of ownership (including any land owned as a partner, corporation, joint tenant, co-tenant, or as a tenant-by-the-entirety) and any land on which a purchase and sale agreement or other contract for sale or purchase has been executed;
- (7) For NWP 31- Maintenance of Existing Flood Control Projects, the prospective permittee must either notify the District Engineer with a Pre-Construction Notification (PCN) prior to each maintenance activity or submit a five year (or less) maintenance plan. In addition, the PCN must include all of the following:
 - (i) Sufficient baseline information so as to identify the approved channel depths and configurations and existing facilities. Minor deviations are authorized, provided that the approved flood control protection or drainage is not increased;

(ii) A delineation of any affected special aquatic sites, including wetlands; and,

(iii) Location of the dredged material disposal site.

(8) For NWP 33-Temporary Construction, Access, and Dewatering, the PCN must also include a restoration plan of reasonable measures to avoid and minimize adverse effects to aquatic resources.

(c) Form of Notification: The standard individual permit application form (Form ENG 4345) may be used as the notification but must clearly indicate that it is a PCN and must include all of the information required in (b) (1)-(7) of General Condition 13. A letter may also be used.

(d) District Engineer's Decision: In reviewing the pre-construction notification for the proposed activity, the District Engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. The prospective permitter may, optionally, submit a proposed mitigation plan with the pre-construction notification to expedite the process and the District Engineer will consider any optional mitigation the applicant has included in the proposal in determining whether the net adverse proposed work are minimal. If the District Engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects are minimal, the District Engineer will notify the permitter and include any conditions the DE deems necessary.

Any mitigation proposal must be approved by the District Engineer prior to commencing work. If the prospective permitter elects to submit a mitigation plan, the District Engineer will expeditiously review the proposed mitigation plan, but will not commence a second 30-day (or 45-day for NWP 26) notification procedure. If the net adverse effects of the project (with the mitigation proposal) are determined by the District Engineer to be minimal, the District Engineer will provide a timely written response to the applicant stating that the project can proceed under the terms and conditions of the nationwide permit.

If the District Engineer determines that the adverse effects of the proposed work are more than minimal, then he will notify the applicant either: (1) that the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (2) that the project is authorized under the NWP subject to the applicant's submitting a mitigation proposal that would reduce the adverse effects to the minimal level; or (3) that the project is authorized under the NWP with specific modifications or conditions.

(e) Agency Coordination: The District Engineer will consider any comments from Federal and State agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

(i) For NWPs 14, 21, 26 (between 1 and 3 acres of impact), 29, 33, 37 and 38, the District Engineer will, upon receipt of a notification, provide immediately, e.g., facsimile transmission, overnight mail or other expeditious manner, a copy to the appropriate offices of the Fish and

Wildlife Service, State natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO), and, if appropriate, the National Marine Fisheries Service. With the exception of NWP 37, these agencies will then have 5 calendar days from the date the material is transmitted to telephone or fax the District Engineer notice that they intend to provide substantive, site-specific comments. If so contacted by an agency, the District Engineer will wait an additional 10 calendar days (16 calendar days for NWP 26 PCNs) before making a decision on the notification. The District Engineer will fully consider agency comments received within the specified time frame, but will provide no response to the resource agency. The District Engineer will indicate in the administrative record associated with each notification that the resource agencies' concerns were considered. Applicants are encouraged to provide the Corps multiple copies of notifications to expedite agency notification.

(ii) Optional Agency Coordination. For NWPs 5, 7, 12, 13, 17, 18, 27, 31, and 34, where a Regional Administrator of EPA, a Regional Director of USFWS, or a Regional Director of NMFS has formally requested general notification from the District Engineer for the activities covered by any of these NWPs the Corps will provide the requesting agency with notification on the particular NWPs. However, where the agencies have a record of not generally submitting substantive comments on activities covered by any of these NWPs, the Corps district may discontinue providing notification to those regional agency offices. The District Engineer will coordinate with the resources agencies to identify which activities involving a PCN that the agencies will provide substantive comments to the Corps. The District Engineer may also request comments from the agencies on a case by case basis when the District Engineer determines that such comments would assist the Corps in reaching a decision whether effects are more than minimal either individually or cumulatively.

(iii) Optional Agency Coordination. 401 Denial. For NWP 26 only, where the state has denied its 401 water quality certification for activities with less than 1 acre of wetland impact, the EPA regional administrator may request agency coordination of PCNs between 1/3 and 1 acre. The request may only include acreage limitations within the 1/3 to 1 acre range for which the state has denied water quality certification. In cases where the EPA has requested coordination of projects as described here, the Corps will forward the PCN to EPA only. The PCN will then be forwarded to the Fish and Wildlife Service and the National Marine Fisheries Service by EPA under agreements among those agencies. Any agency receiving the PCN will be bound by the EPA timeframes for providing comments to the Corps.

(f) Wetland Delineations: Wetland delineations must be prepared in accordance with the current method required by the Corps. For NWP 29 see paragraph (b)(6)(iii) for parcels less than 0.5 acres in size. The permittee may ask the Corps to delineate the special aquatic site. There may be some delay if the Corps does the delineation. Furthermore, the 30-day period (45 days for NWP 26) will not

start until the wetland delineation has been completed and submitted to the Corps, where appropriate.

(g) Mitigation: Factors that the District Engineer will consider when determining the acceptability of appropriate and practicable mitigation include, but are not limited to:

(i) To be practicable, the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of the overall project purposes;

(ii) To the extent appropriate, permittees should consider mitigation banking and other forms of mitigation including contributions to wetland trust funds, "in lieu fees" to organizations such as The Nature Conservancy, state or county natural resource management agencies, where such fees contribute to the restoration, creation, replacement, enhancement, or preservation of wetlands. Furthermore, examples of mitigation that may be appropriate and practicable include but are not limited to: reducing the size of the project; establishing wetland or upland buffer zones to protect aquatic resource values; and replacing the loss of aquatic resource values by creating, restoring, and enhancing similar functions and values. In addition, mitigation must address wetland impacts, such as functions and values, and cannot be simply used to offset the acreage of wetland losses that would occur in order to meet the acreage limits of some of the NWPs (e.g., for NWP 26, 5 acres of wetlands cannot be created to change a 6-acre loss of wetlands to a 1 acre loss; however, 2 created acres can be used to reduce the impacts of a 3-acre loss.).

14. Compliance certification: Every permitter who has received a Nationwide permit verification from the Corps will submit a signed certification regarding the completed work and any required mitigation. The certification will be forwarded by the Corps with the authorization letter and will include: a.) A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions; b.) A statement that any required mitigation was completed in accordance with the permit conditions; c.) The signature of the permitter certifying the completion of the work and mitigation.

15. Multiple use of Nationwide permits: In any case where any NWP number 12 through 40 is combined with any other NWP number 12 through 40, as part of a single and complete project, the permitter must notify the District Engineer in accordance with paragraphs a, b, and c on the Notification General Condition number 13. Any NWP number 1 through 11 may be combined with any other NWP without notification to the Corps, unless notification is otherwise required by the terms of the NWPs. As provided at 33 CFR 330.6(c) two or more different NWPs can be combined to authorize a single and complete project. However, the same NWP cannot be used more than once for a single and complete project.

COMPLIANCE CERTIFICATION

PERMIT NO. 970000344

DATE OF ISSUANCE - September 22, 1997

Name of Permittee - Natural Energy Laboratory of Hawaii Authority

Upon completion of the activity authorized by this permit and any mitigation required by the permit, please sign this certification and return it to the following address:

U.S. Army Corps of Engineers
Honolulu District
Attn: Regulatory Section
Building 230
Fort Shatter, Hawaii 96858-5440

Please note that your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with this permit, you are subject to permit suspension, modification or revocation.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

Signature of Permittee

Date

Appendix F: West Hawaii Today Article

Feds to Test Impact of Dumping CO₂ into Kona Waters

Source: B. Command, "Feds to Test Impact of Dumping CO₂ into Kona Waters," *West Hawaii Today*, March 18, 1999, pp. 1, 4A.

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WEST HAWAII TODAY

Thursday, March 18, 1999 • VOL. XXXI, NO. 11 • 32 Pages • 50 Cents

Feds to test impact of dumping CO2 into Kona waters

By **BOBBY COMMAND**
West Hawaii Today

A growing concern about increased levels of greenhouse gasses in the atmosphere has led the federal government to the Kona Coast to examine the disposal of carbon dioxide in the ocean.

Preliminary tests already have shown the technology could have a negative impact on the environment and chemistry of the sea.

The U.S. Department of Energy and Japan's Ministry of International Trade and Industry formed a partnership last year to conduct a month-long experiment in Kona waters to see what the disposal of carbon dioxide (CO2) will do to the environment and chemistry of the ocean. No dates for such an experiment have been announced.

Known as carbon sequestration, dumping CO2 into the ocean is being touted as a possible solu-

See **NORWAY:**
Page 4A

...Norway already uses ocean to dump CO2

From Page 1A

tion to the greenhouse effect, which has been blamed for everything from the melting of the polar ice caps to severe weather episodes.

Primarily released through the burning of fossil fuels, CO2 acts as a blanket on the atmosphere, functioning as a greenhouse to trap the heat of the Sun and raise average temperatures on Earth.

The Energy Department also has said the technology could allow coal to remain a viable source of cheap energy.

According to an Energy Department official, just keeping CO2 concentrations in the atmosphere at double the current level would require cutting global emissions by almost 70 percent from 1990 levels.

Robert S. Kripowicz, acting assistant secretary for fossil energy, told the National Coal Council last year that if the world hopes to reduce CO2 levels, ocean sequestration may be the best hope, and the coal industry's only hope in the long run.

Kripowicz has recommended using the ocean and deep sea floor as a vast sink or storage basin.

A Massachusetts Institute of Technology report, commissioned

by the Energy Department, examined five methods of ocean CO2 sequestration:

- Dry ice dumped from ships into the ocean, which will have little impact on the environment, but is expensive because of refrigeration costs;

- Liquid CO2 injected at a depth of about 3,300 feet from a pipe towed by a moving ship and forming a droplet plume.

While the technique would be cheap and have little environmental impact, the technology has yet to be developed;

- Liquid CO2 injected at a depth of about 3,300 feet from a manifold lying on the ocean floor to form a rising droplet plume.

This is cheap, but there would be leakage and interaction with the environment;

- Creating a dense CO2-seawater mixture created at a depth of between 500 and 1,650 feet to form a sinking plume.

The study calls this an expensive and environmentally poor way of disposing CO2; and

- Liquid CO2 being piped into a sea floor depression to form a stable "deep lake" at a depth of more than 13,000 feet.

The technique would leak very little CO2 back into the atmosphere

and have little effect on the environment, but would be very expensive to develop.

The Energy Department has concluded the only feasible option is to inject liquid CO2 into the ocean at the 3,300-foot depth to form the rising droplet plume.

The other techniques, according to the Department of Energy, are too expensive or lack the technology.

According to the Energy Department, most studies have shown the major effort on the environment is reduced pH of seawater, especially near the injection point.

The normal pH of seawater, about 8, may be cut in half, which would injure or kill plankton and bacteria.

However, the Energy Department study also said proper design of a CO2 sequestration system would avoid most of the negative impact on marine organisms.

The sea already is being used to dispose of carbon dioxide. Norway is pumping liquid CO2 from its natural gas fields into a sandstone aquifer more than 3,000 feet beneath the North Sea. Additionally, Exxon and Pertamina have announced plans to inject CO2 into an undersea aquifer below the South China Sea floor.

Appendix G: Technical Committee

Technical Committee

Source: CO₂ Ocean Sequestration Field Experiment [Internet], Honolulu (HI): Project Team; [updated April 23, 2001; cited May 8, 2002]. Available from: <http://www.co2experiment.org/staff.htm>.

Technical Committee

E. Eric Adams

- Technical Committee member
- Scientific Coordinator
- Senior Research Engineer and Lecturer, Department of Civil and Environmental Engineering (CEE), Massachusetts Institute of Technology (MIT), U.S.A.
- Associate Director for Research, MIT Sea Grant College Program
- Ph.D., Hydrodynamics, MIT, 1975
- Areas of specialization: environmental fluid mechanics; physical and mathematical modeling of pollutant transport and mixing; hydrologic tracer studies

Makoto Akai

- Technical Committee member
- Project Manager
- Senior Researcher, Mechanical Engineering Laboratory, MITI/AIST, Japan
- Ph.D., Nuclear Engineering, Tokyo Institute of Technology, 1980
- Areas of specialization: energy conversion; two-phase flow; heat transfer; environmental economics; global energy modeling; life cycle analysis

Guttorm Alendal

- Technical Committee member
- Senior Scientist, Nansen Environmental and Remote Sensing Center (NERSC), Norway
- Dr. Sc., Applied Mathematics, University of Bergen, 1996
- Areas of specialization: geophysical fluid mechanics; applied mathematics; computational fluid mechanics; plasma dynamics; large-eddy simulations

Richard B. Coffin

- Technical Committee member
- Senior Research Biogeochemist, Hawaii Natural Energy Institute, University of Hawaii
- M.S., Marine Microbiology, University of New Hampshire, 1979-1981.
- Ph. D., Chemical Oceanography, University of Delaware, 1983-1986.
- Areas of specialization: ocean carbon cycling, carbon isotope geochemistry, biogeochemistry, methane hydrate formation and fate, environmental stresses and remediation

Lars G. Golmen

- Technical Committee member
- Research Manager & Scientist, Physical Oceanography Department, Norwegian Institute for Water Research (NIVA), Norway
- Cand. Real. Degree (Ph.D. equivalent), Physical Oceanography, University of Bergen, 1983

- Areas of specialization: fjord and coastal oceanography and dynamics; chemical oceanography (tracers); bottom water formation and polar oceanography; ocean energy; thermodynamics; plume and outfall modeling

Peter M. Haugan

- Technical Committee member
- Associate Professor, Geophysical Institute, University of Bergen, Norway
- Cand. Real. Degree, Applied Mathematics, University of Bergen, 1982
- Dr. Philos., Oceanography, University of Bergen, 1999
- Areas of specialization: physical oceanography; polar oceanography; ocean climate variability; ocean mixing processes

Howard J. Herzog

- Technical Committee Chair
- Principal Research Engineer, Energy Laboratory, Massachusetts Institute of Technology, U.S.A.
- Chemical Engineer's Degree, Chemical Engineering, MIT, 1980
- M.S., Chemical Engineering Practice, Chemical Engineering, MIT, 1995
- Areas of specialization: carbon management; greenhouse gas mitigation technologies; advanced geothermal energy systems; environmental remediation

Shigeo Masuda

- Technical Committee member
- Chief Scientist, Research Institute of Innovative Technology for the Earth (RITE), Japan
- Ph.D., Applied Chemistry, Kyushu University, 1979
- Areas of specialization: rheology; polymers; optical fibers; material sciences; greenhouse gas mitigation

Stephen M. Masutani

- Technical Committee member
- Site Manager
- Associate Professor, Hawaii Natural Energy Institute, University of Hawaii, U.S.A.
- Cooperating Graduate Faculty, Departments of Mechanical and Ocean Engineering, University of Hawaii
- Ph.D., Mechanical Engineering, Stanford, 1985
- Areas of specialization: turbulent fluid mechanics; multi-phase flow; flame diagnostics; chemical kinetics; renewable energy systems; pollutant control

Richard J. Matear

- Technical Committee member
- Senior Scientist, CSIRO Marine Research, Hobart, Australia
- Ph.D., Oceanography, University of British Columbia, 1993
- Areas of specialization: chemical oceanography, marine carbon cycle, ocean and climate modeling

Norikazu Nakashiki

- Technical Committee member
- Research Scientist, Environmental Science Department, Abiko Research Laboratory, Central Research Institute of Electric Power Industry (CRIEPI), Japan
- Ph.D., Civil Engineering, Kyushu University, 1996
- Areas of specialization: environmental fluid mechanics; physical oceanography; coastal ocean modeling; ocean general circulation model; pollutant transport modeling

Gérard C. Nihous

- Technical Committee member
- Senior Research Engineer, Climate Change Program, Pacific International Center for High Technology Research (PICHTER), Honolulu, Hawaii
- Affiliate Graduate Faculty, Department of Ocean and Resources Engineering, University of Hawaii
- Ph.D., Ocean Engineering, University of California at Berkeley, 1983
- Areas of specialization: hydrodynamics; Ocean Thermal Energy Conversion (OTEC); renewable energy systems; greenhouse gas mitigation technologies

Takashi Ohsumi

- Technical Committee member
- Research Fellow, Abiko Research Laboratory, Central Research Institute of Electric Power Industry, Japan
- Ph.D., Geochemistry, University of Tokyo, 1983
- Areas of specialization: mass spectrometry; isotope hydrology; volcanic gas and CO₂ geochemistry; geothermal energy; CO₂ sequestration technology

Masahiko Ozaki

- Technical Committee member
- Technical Manager
- Research Manager, Nagasaki Research and Development Center, Mitsubishi Heavy Industries, Ltd., Japan
- Senior Researcher, Research Institute of Innovative Technology for the Earth (RITE), Japan
- Ph.D., Naval and Ocean Engineering, University of Tokyo, 1983
- Areas of specialization: ocean engineering; structural dynamics in waves; mooring and line structures

Yoshihisa Shirayama

- Technical Committee member
- Director and Professor, Seto Marine Biological Laboratory, Kyoto University, Japan
- D. SC., Zoology, Graduate School of Science, University of Tokyo, 1982

- Areas of specialization: ecology and physiology of marine meiobenthos, especially in the deep sea; taxonomy and phylogeny of xenophyophores, nematodes, loriciferans and kinorhynchans; application of meiobenthos for environmental biomonitoring

Craig R. Smith

- Technical Committee member
- Professor of Oceanography, School of Ocean and Earth Science and Technology, University of Hawaii
- Ph.D., Biological Oceanography, Scripps Institution of Oceanography, UCSD, 1983
- Areas of specialization: benthic biological oceanography, sediment community processes, deep-sea biology, bioturbation, benthic-pelagic coupling, Antarctic ecology, whale-fall ecology

Eric W. Vetter

- Technical Committee member
- Associate Professor, Marine Science Program, Hawaii Pacific University
- Affiliate Graduate Faculty, SOEST, University of Hawaii
- Ph.D., Biological Oceanography, Scripps Institution of Oceanography, UCSD, 1995
- Areas of specialization: submarine canyon ecology; secondary production of the marine benthos; response of sediment communities to organic enrichment; leptostracan systematics

C.S. Wong

- Technical Committee member
- Senior Scientist/Team Leader, Climate Chemistry Laboratory, Institute of Ocean Sciences, Canada
- Ph.D., Chemical Oceanography, Scripps Institution of Oceanography, University of California, San Diego, 1968
- Areas of specialization: chemistry; chemical oceanography; physical oceanography; carbon cycle; marine pollution

Appendix H: Correspondence from Rep. Jim Rath

Correspondence from Rep. Jim Rath to Dr. Gerard Nihous (PICHTR)



HOUSE OF REPRESENTATIVES

STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

February 28, 2001

Mr. Gerard Nihous, PhD
PITHTR
2800 Woodlawn Drive, Ste. 180
Honolulu, HI 96822

Dear Mr. Nihous,

I do not believe that I have ever had the pleasure of meeting you. However, I recently read your letter to the editor in West Hawaii Today. In that letter you detail your time in the United States, your status as a citizen, your term of residence in Hawaii and your marital state along with your wife's place of birth. In addition, you make reference to many of the people in West Hawaii and allude to their motivations in opposing the Co2 experiment, refuse to apologize for your use of proper English, and seem critical of my carefree use of profanity.

Having been mentioned by name I would, of course, like to respond to your letter.

First, as to where you were born, how long you have been in the US and whether you are a citizen or not, I could really care less. It is not where you were born, that counts. It is what you do with the rest of your life. Case in point: Bob Hope was born in England and you'll not find anyone, anywhere in the US, with an ill word for that magnificent American.

Second, that you have found a wife and are married, I think is wonderful and I hope it is both a happy and long lasting marriage. I don't see any relevance to the Co2 experiment, but congratulations anyway.

Third, it is obvious that you know very little about the people in West Hawaii, which leads me to speculate about other vacancies in your knowledge.

Lastly, I did not use profanity. My statement, "Screw 'em" is slang and while it may be vulgar, which ironically means common, it was not profane. A truly profane statement would be something such as, "Fuck you! Stronger message to follow."

With best regards,

A handwritten signature in black ink, appearing to read "Jim Rath", with a large, stylized flourish at the end.

Jim Rath

Appendix I: HCR64

Source: Hawaii State Legislature [Internet], Honolulu (HI): Status and Documents; [cited May 8, 2002]. Available from:
<http://www.capitol.hawaii.gov/site1/archives/2001/default.asp?press1=archives>.

This is a copy of the final resolution that passed the Hawaii State Legislature.

Report Title:

Requesting Congress to enact stronger energy policies

HOUSE OF REPRESENTATIVES TWENTY-FIRST LEGISLATURE, 2001 STATE OF HAWAII	H.C.R. NO.	64 H.D. 1 S.D. 1
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HOUSE CONCURRENT RESOLUTION

REQUESTING THE UNITED STATES CONGRESS TO ENACT STRONGER ENERGY POLICIES THAT WILL IMPROVE ENERGY EFFICIENCY, DEVELOP AND ENCOURAGE RENEWABLE ENERGY, REDUCE GASOLINE CONSUMPTION FOR TRANSPORTATION, AND SWITCH FROM FOSSIL FUELS TO ALTERNATIVE FUELS.

WHEREAS, an Intergovernmental Panel on Climate Change report released on January 1, 2001 stated that, "An increasing body of observations gives a collective picture of a warming world and other changes in the climate system"; and

WHEREAS, this report builds on past assessments of climate data and incorporates new analysis that provides further evidence of global climate change attributable to human emissions of greenhouse gases; and

WHEREAS, the most certain method to address human effects on global climate is to curb emissions of greenhouse gases through extensive use of renewable energy sources, energy conservation, and energy efficiency; and

WHEREAS, the Federal government has not dedicated resources towards these methods to curb greenhouse gas emissions on a scale commensurate with the problem of climate change; and

WHEREAS, President Bush's recent decision to not regulate carbon dioxide emissions further deviates from policies that address the problem of climate change; and

WHEREAS, with four percent of the world's population but twenty-five percent of global greenhouse gas production, the United States has moral and ethical obligations to our future citizens and also to other nations to address the problem of climate change; and

WHEREAS, recent criticism from European Union nations about President Bush's commitment to addressing climate change underscores the fact that this issue affects national interests; and

WHEREAS, the United States must consider a national energy policy that diversifies our energy supplies to shield consumers from price spikes, reduce our over-reliance on polluting fossil fuels, and promotes much more aggressively the use of clean renewable energy and energy efficient resources; and

WHEREAS, the U.S. Department of Energy has proposed a field experiment involving the injection of forty to sixty metric tons of liquefied carbon dioxide into the ocean at the Natural Energy Laboratory of Hawaii Authority Research Corridor located in Kona, Hawaii; and

WHEREAS, numerous concerned citizens have raised legitimate concerns over the environmental impact of this carbon dioxide ocean sequestration experiment including, but not limited to, changes in seawater chemistry, effects on marine organisms in the vicinity of the experiment, and the need for an Environmental Impact Statement; and

WHEREAS, one of the stated goals of the U.S. Department of Energy's Carbon Sequestration Program is to develop sequestration practices that do not introduce any new environmental problems; now, therefore,

BE IT RESOLVED by the House of Representatives of the Twenty-First Legislature of the State of Hawaii, Regular Session of 2001, the Senate concurring, that the United States Congress is requested to enact stronger energy policies that will improve energy efficiency, develop and encourage renewable energy, reduce gasoline consumption for transportation, and switch from fossil fuels to alternative fuels; and

BE IT FURTHER RESOLVED that the proponents of the carbon dioxide ocean sequestration experiment must address and disclose, through the public hearing process, all concerns, potential impacts, and mitigating measures in environmental documents required under all applicable environmental laws and regulations, including but not limited to the National Environmental Policy Act; and

BE IT FURTHER RESOLVED that certified copies of this Concurrent Resolution be transmitted to the President of the United States, the U.S. Secretary of Energy, the Hawaii Congressional Delegation, the Director of Business, Economic Development, and Tourism, the Director of Health, the Office of Environmental Quality Control, the

Natural Energy Laboratory of Hawaii Authority, and the Pacific International Center for High Technology Research.

Appendix J: HR64 and HCR64 Legislative History

Source: Hawaii State Legislature [Internet], Honolulu (HI): Status and Documents; [cited May 8, 2002]. Available from:
<http://www.capitol.hawaii.gov/site1/archives/2001/default.asp?press1=archives>.

Summary of Documents

The following documents provide a summary of the legislative history of HR64 and HCR64.

- Document 1 provides a chronology of events for HR64.
- Document 2 is the first draft of the resolution, as introduced by Representatives Hale, Whalen, Kanohe, and Takamine.
- Document 3 is a report of the House Committee on Energy and Environmental Protection, the House committee that took up the resolution.
- Document 4 is a redrafted resolution produced by the House committee.

After this redraft, HR64 HD1 became known as HCR64 and received its own status in the Hawaii State Legislature.

- Document 5 provides a chronology of events for HCR64. Note that the Hawaii State Legislature includes the legislative history for HR64 when it summarizes the new resolution.
- Documents 6, 7, and 8 have the same contents as Documents 2, 3, and 4, but the Hawaii State Legislature has changed the titles and provided separate report numbers. The legislature does this to provide the public with all prior versions of legislation.
- Document 9 is a report of the Senate Committee on Water, Land, Energy and Environment on HCR64, the Senate committee that took up the resolution.
- Document 10 is a redrafted resolution produced by the Senate committee.

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Document J-1: Status Report Summarizing History of HR64

**Hawaii State Legislature
2001 Regular Session**

HR64 HD1

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Measure Title: OPPOSING ANY RESUMPTION OF THE PROPOSAL TO CONDUCT CARBON DIOXIDE EXPERIMENTS OFF THE KONA COAST. (AMEND TITLE)

Report Title: Requesting Congress to enact stronger energy policies

Description:

Package: None

Companion: HCR64

Introducer(s): HALE, Whalen, Kanohe, Takamine

Current Referral: EEP

Date		Status Text
3/12/01	H	Filed.
3/13/01	H	Offered
3/14/01	H	Referred to the committee on EEP, referral sheet 31.
3/19/01	H	Resolution scheduled to be heard by EEP on Thursday, 03/22/01 at 8:30 AM in House conference room 312.
3/22/01	H	The committee(s) recommends that the measure be deferred.
4/2/01	H	Resolution scheduled to be heard by EEP on Thursday, 04-05-01 at 9:15 AM in House conference room 325.
4/5/01	H	The committees on EEP recommend that the measure be PASSED, WITH AMENDMENTS. The votes were as follows: 8 Ayes: Rep.(s) Morita, Schatz, Hale, Kanohe, B. Oshiro, Bukoski, Jaffe, Thielen; Ayes with reservations: None 0 Noes: None; and 2 Excused: Rep.(s) Ito, Meyer.
4/6/01	H	Reported from the committee on EEP (Stand. Com. Rep. No. 1217) as amended in (HD 1), recommending adoption.
4/6/01	H	Adopted as amended in (HD 1) with None voting no and Rep.(s) Ahu Isa, Marumoto, Rath excused.

Document J-2: Draft 1 of HR64

Report Title:

Oppose Carbon Dioxide Experiments off Kona Coast

HOUSE OF REPRESENTATIVES TWENTY-FIRST LEGISLATURE, 2001 STATE OF HAWAII	H.R. NO.	64
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HOUSE RESOLUTION

opposing any resumption of the proposal to conduct carbon dioxide experiments off the Kona coast.

WHEREAS, the Board of Directors of the Natural Energy Laboratory of Hawaii Authority (NELHA) recently voted to exclude an experiment with carbon dioxide from its Kona waters; and

WHEREAS, the NELHA board had earlier given a preliminary approval to the experiment on carbon dioxide "sequestration," or the locking of carbon dioxide in ocean water; and

WHEREAS, the experiment, under the direction of the Pacific International Center for High Technology Research, would pump small amounts of liquefied carbon dioxide two hours at a time, increasing to 7.6 metric tons in two hours; and

WHEREAS, scientists anticipate that a plume of droplets would rise and dissolve in the water and the droplets would turn the water in the fifty-foot-wide plume from its normal slight alkalinity to a slight acidity, and that the effects could last six to twelve hours; and

WHEREAS, the purpose of the experiment is to determine exactly how big the plume is, how acidic, and how long it lasts; and

WHEREAS, the NELHA board, however, voted against this experiment in its final form because of concerns about its scientific merits, possible legal ramifications, a change in scope, general public opposition, and opposition by the Keahole Point Tenants Association; and

WHEREAS, opponents quoted the Union of Concerned Scientists, which said ocean sequestration is untested and that it must be carefully studied; and

WHEREAS, research groups have used this same argument to press for testing; and

WHEREAS, the NELHA exclusion applies only to a defined area of ocean at Keahole Point about two miles wide and 2.6 miles out to sea; and

WHEREAS, the experiment might still be done in the general area, perhaps outside the State's 3-mile-wide territorial waters; now, therefore,

BE IT RESOLVED by the House of Representatives of the Twenty-First Legislature of the State of Hawaii, Regular Session of 2001, that the Legislature states its opposition to any resumption of the proposal to conduct carbon dioxide experiments in Hawaiian waters; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the Board of Directors of the Natural Energy Laboratory of Hawaii Authority and to the Board of Directors of the Pacific International Center for High Technology Research.

OFFERED BY: _____

Document J-3: Report of House Committee on Energy and Environmental Protection

STAND. COM. REP. NO. 1217
Honolulu, Hawaii
, 2001

RE: H.R. No. 64
H.D. 1

Honorable Calvin K.Y. Say
Speaker, House of Representatives
Twenty-First State Legislature
Regular Session of 2001
State of Hawaii

Sir:

Your Committee on Energy and Environmental Protection, to which was referred H.R. No. 64 entitled:

"HOUSE RESOLUTION OPPOSING ANY RESUMPTION OF THE PROPOSAL TO CONDUCT CARBON DIOXIDE EXPERIMENTS OFF THE KONA COAST,"

begs leave to report as follows:

The purpose of this resolution was to oppose a proposed experiment involving the ocean sequestration of carbon dioxide.

Your Committee received testimony from 38 concerned citizens and representatives of organizations in support of this measure, citing a broad range of possible environmental and economic risks from the proposed experiment. A videotape and a petition in support were also submitted. Opposition to the resolution was also voluminous, with testimony from 24 scientists, most of whom are involved in the experiments. The Chairman of the Pacific International Center for High Technology Research also testified against the measure. The Natural Energy Laboratory of Hawaii Authority recommended certain corrections, and the University of Hawaii Environmental Center offered comments.

Your Committee finds this to be a highly controversial issue which may present unintended ramifications for research funding in unrelated programs. Moreover, the real impacts of the project remain unclear. Both opponents and proponents of the measure brought forth compelling arguments to support their positions. The level of public interest

and concern warrant a full discussion and disclosure which is not afforded in this legislative process. Therefore, your Committee finds that a thorough review under the National Environmental Policy Act would be the best venue to evaluate the merits of the proposed carbon dioxide ocean sequestration experiments.

Furthermore, your Committee finds that the subject experiment stems from a federal actions that favor carbon dioxide sequestering rather than emissions reductions. Your Committee questions the wisdom of such actions and the recent decision of the President of the United States not to regulate carbon dioxide emissions.

Therefore, your Committee has amended House Resolution 64 by:

- (1) Deleting the contents of the original measure; and
- (2) Substituting a resolution requesting the U.S. Congress to enact policies that will improve energy efficiency and develop energy alternatives that do not contribute to greenhouse gases.

As affirmed by the record of votes of the members of your Committee on Energy and Environmental Protection that is attached to this report, your Committee concurs with the intent and purpose of H.R. No. 64, as amended herein, and recommends its adoption in the form attached hereto as H.R. No. 64, H.D. 1.

Respectfully submitted on behalf of
the members of the Committee on
Energy and Environmental
Protection,

Hermína M. Morita, Chair

Document J-4: Draft 2 of HR64 (Redrafted by House Committee on Energy and Environmental Protection)

Report Title:

Requesting Congress to enact stronger energy policies

HOUSE OF REPRESENTATIVES TWENTY-FIRST LEGISLATURE, 2001 STATE OF HAWAII	H.R. NO.	64 H.D. 1
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HOUSE RESOLUTION

requesting the United States Congress to enact stronger energy policies that will improve energy efficiency, develop and encourage renewable energy, reduce gasoline consumption for transportation, and switch from fossil fuels to alternative fuels.

WHEREAS, an Intergovernmental Panel on Climate Change report released on January 1, 2001 stated that, "An increasing body of observations gives a collective picture of a warming world and other changes in the climate system"; and

WHEREAS, this report builds on past assessments of climate data and incorporates new analysis that provides further evidence of global climate change attributable to human emissions of greenhouse gases; and

WHEREAS, the most certain method to address human effects on global climate is to curb emissions of greenhouse gases through extensive use of renewable energy sources, energy conservation, and energy efficiency; and

WHEREAS, the Federal government has not dedicated resources towards these methods to curb greenhouse gas emissions on a scale commensurate with the problem of climate change; and

WHEREAS, President Bush's recent decision to not regulate carbon dioxide emissions further deviates from policies that address the problem of climate change; and

WHEREAS, with 4% of the world's population but 25% of global greenhouse gas production, the United States has moral and ethical obligations to our future citizens and also to other nations to address the problem of climate change; and

WHEREAS, recent criticism from European Union nations about President Bush's commitment to addressing climate change underscores the fact that this issue affects national interests; and

WHEREAS, the United States must consider a national energy policy that diversifies our energy supplies to shield consumers from price spikes, reduce our over-reliance on polluting fossil fuels, and promotes much more aggressively the use of clean renewable energy and energy efficient resources; and

WHEREAS, the U.S. Department of Energy has proposed a field experiment involving the injection of 40 to 60 metric tons of liquefied carbon dioxide into the ocean at the Natural Energy Laboratory of Hawaii Authority Research Corridor located in Kona, Hawaii; and

WHEREAS, numerous concerned citizens have raised legitimate concerns over the environmental impact of this carbon dioxide ocean sequestration experiment including, but not limited to, changes in seawater chemistry and effects on marine organisms in the vicinity of the experiment; and

WHEREAS, one of the stated goals of the Department of Energy's Carbon Sequestration Program is to develop sequestration practices that do not introduce any new environmental problems; now, therefore,

BE IT RESOLVED by the House of Representatives of the Twenty-first Legislature of the State of Hawaii, Regular Session of 2001, requests that the United States Congress enact stronger energy policies that will improve energy efficiency, develop and encourage renewable energy, reduce gasoline consumption for transportation, and switch from fossil fuels to alternative fuels; and

BE IT FURTHER RESOLVED that the proponents of the carbon dioxide ocean sequestration experiment must address and disclose all concerns, potential impacts, and mitigative measures in environmental documents required under all applicable environmental laws and regulations, including but not limited to the National Environmental Policy Act; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the President of the United States, the U.S. Secretary of Energy, the Hawaii Congressional Delegation, the Director of the Department of Business, Economic Development, and Tourism, the Office of Environmental Quality Control, the Natural Energy Laboratory of Hawaii Authority, and the Pacific International Center for High Technology Research.

Document J-5: Status Report Summarizing History of HCR64

**Hawaii State Legislature
2001 Regular Session**

HCR64 HD1 SD1

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Measure Title: REQUESTING THE UNITED STATES CONGRESS TO ENACT STRONGER ENERGY POLICIES THAT WILL IMPROVE ENERGY EFFICIENCY, DEVELOP AND ENCOURAGE RENEWABLE ENERGY, REDUCE GASOLINE CONSUMPTION FOR TRANSPORTATION, AND SWITCH FROM FOSSIL FUELS TO ALTERNATIVE FUELS. (AMEND TITLE)

Report Title: Requesting Congress to enact stronger energy policies

Description:

Package: None

Companion: HR64

Introducer(s): HALE, Whalen, Kanoho, Takamine

Current Referral: WLE

Date		Status Text
3/12/01	H	Filed.
3/13/01	H	Offered
3/14/01	H	Referred to the committee on EEP, referral sheet 31.
3/19/01	H	Resolution scheduled to be heard by EEP on Thursday, 03/22/01 at 8:30 AM in House conference room 312.
3/22/01	H	The committee(s) recommends that the measure be deferred.
4/2/01	H	Resolution scheduled to be heard by EEP on Thursday, 04-05-01 at 9:15 AM in House conference room 325.
4/5/01	H	The committees on EEP recommend that the measure be PASSED, WITH AMENDMENTS. The votes were as follows: 8 Ayes: Rep.(s) Morita, Schatz, Hale, Kanoho, B. Oshiro, Bukoski, Jaffe, Thielen; Ayes with reservations: None 0 Noes: None; and 2 Excused: Rep.(s) Ito, Meyer.
4/6/01	H	Reported from the committee on EEP (Stand. Com. Rep. No. 1218) as amended in (HD 1), recommending adoption.

4/6/01	H	Adopted as amended in (HD 1) with None voting no and Rep.(s) Ahu Isa, Marumoto, Rath excused.
4/10/01	S	Received from House (Hse. Com. No. 379).
4/10/01	S	Referred to WLE.
4/17/01	S	Resolution scheduled to be heard by WLE on 04-19-01 at 3:15 PM in conference room 224.
4/19/01	S	The committee(s) on WLE recommend(s) that the measure be PASSED, WITH AMENDMENTS.
4/19/01	S	The votes in WLE were as follows: 6 Aye(s): Senator(s) Inouye, Chun Oakland, English, Ihara, Kokubun, Matsunaga; Aye(s) with reservations: None; 0 No(es): None; and 3 Excused: Senator(s) Chun, Nakata, Hemmings.
4/23/01	S	Reported from WLE (Stand. Com. Rep. No. 1700) with recommendation of adoption, as amended (SD 1).
4/23/01	S	Report and Resolution Adopted, as amended (SD 1).
4/23/01	S	Transmitted to House.
4/23/01	H	Received from Senate (Sen. Com. No. 744) in amended form (SD 1).
4/25/01	H	House agrees to Senate amendment(s).
4/25/01	H	Adopted as amended in SD1 with None voting no and Case, Souki, Stonebraker, Whalen, Yonamine excused.
4/26/01	S	Received notice of agreement and adoption in House (Hse. Com. No. 663).
5/9/01	H	Transmitted to Public.

Document J-6: Draft 1 of HCR64

Report Title:

Oppose Carbon Dioxide Experiments off Kona Coast

HOUSE OF REPRESENTATIVES TWENTY-FIRST LEGISLATURE, 2001 STATE OF HAWAII	H.C.R. NO.	64
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HOUSE CONCURRENT RESOLUTION

opposing any resumption of the proposal to conduct carbon dioxide experiments off the Kona coast.

WHEREAS, the Board of Directors of the Natural Energy Laboratory of Hawaii Authority (NELHA) recently voted to exclude an experiment with carbon dioxide from its Kona waters; and

WHEREAS, the NELHA board had earlier given a preliminary approval to the experiment on carbon dioxide "sequestration," or the locking of carbon dioxide in ocean water; and

WHEREAS, the experiment, under the direction of the Pacific International Center for High Technology Research, would pump small amounts of liquefied carbon dioxide two hours at a time, increasing to 7.6 metric tons in two hours; and

WHEREAS, scientists anticipate that a plume of droplets would rise and dissolve in the water and the droplets would turn the water in the fifty-foot-wide plume from its normal slight alkalinity to a slight acidity, and that the effects could last six to twelve hours; and

WHEREAS, the purpose of the experiment is to determine exactly how big the plume is, how acidic, and how long it lasts; and

WHEREAS, the NELHA board, however, voted against this experiment in its final form because of concerns about its scientific merits, possible legal ramifications, a change in scope, general public opposition, and opposition by the Keahole Point Tenants Association; and

WHEREAS, opponents quoted the Union of Concerned Scientists, which said ocean sequestration is untested and that it must be carefully studied; and

WHEREAS, research groups have used this same argument to press for testing; and

WHEREAS, the NELHA exclusion applies only to a defined area of ocean at Keahole Point about two miles wide and 2.6 miles out to sea; and

WHEREAS, the experiment might still be done in the general area, perhaps outside the State's 3-mile-wide territorial waters; now, therefore,

BE IT RESOLVED by the House of Representatives of the Twenty-First Legislature of the State of Hawaii, Regular Session of 2001, the Senate concurring, that the Legislature states its opposition to any resumption of the proposal to conduct carbon dioxide experiments in Hawaiian waters; and

BE IT FURTHER RESOLVED that certified copies of this Concurrent Resolution be transmitted to the Board of Directors of the Natural Energy Laboratory of Hawaii Authority and to the Board of Directors of the Pacific International Center for High Technology Research.

OFFERED BY: _____

**Document J-7: Report of House Committee on Energy and Environmental
Protection of HCR64**

STAND. COM. REP. NO. 1218
Honolulu, Hawaii
, 2001

Honorable Calvin K.Y. Say
Speaker, House of Representatives
Twenty-First State Legislature
Regular Session of 2001
State of Hawaii

Sir:

Your Committee on Energy and Environmental Protection, to which was referred H.C.R. No. 64 entitled:

"HOUSE CONCURRENT RESOLUTION OPPOSING ANY RESUMPTION OF THE PROPOSAL TO CONDUCT CARBON DIOXIDE EXPERIMENTS OFF THE KONA COAST,"

begs leave to report as follows:

The purpose of this resolution was to oppose a proposed experiment involving the ocean sequestration of carbon dioxide.

Your Committee received testimony from 38 concerned citizens and representatives of organizations in support of this measure, citing a broad range of possible environmental and economic risks from the proposed experiment. A videotape and a petition in support were also submitted. Opposition to the resolution was also voluminous, with testimony from 24 scientists, most of whom are involved in the experiments. The Chairman of the Pacific International Center for High Technology Research also testified against the measure. The Natural Energy Laboratory of Hawaii Authority recommended certain corrections, and the University of Hawaii Environmental Center offered comments.

Your Committee finds this to be a highly controversial issue which may present unintended ramifications for research funding in unrelated programs. Moreover, the real impacts of the project remain unclear. Both opponents and proponents of the measure brought forth compelling arguments to support their positions. The level of public interest and concern warrant a full discussion and disclosure which is not afforded in this legislative process. Therefore, your Committee finds that a thorough review under the

National Environmental Policy Act would be the best venue to evaluate the merits of the proposed carbon dioxide ocean sequestration experiments.

Furthermore, your Committee finds that the subject experiment stems from a federal actions that favor carbon dioxide sequestering rather than emissions reductions. Your Committee questions the wisdom of such actions and the recent decision of the President of the United States not to regulate carbon dioxide emissions.

Therefore, your Committee has amended House Resolution 64 by:

- (1) Deleting the contents of the original measure; and
- (2) Substituting a resolution requesting the U.S. Congress to enact policies that will improve energy efficiency and develop energy alternatives that do not contribute to greenhouse gases.

As affirmed by the record of votes of the members of your Committee on Energy and Environmental Protection that is attached to this report, your Committee concurs with the intent and purpose of H.R. No. 64, as amended herein, and recommends its adoption in the form attached hereto as H.C.R. No. 64, H.D. 1.

Respectfully submitted on behalf of
the members of the Committee on
Energy and Environmental
Protection,

Hermína M. Morita, Chair

Document J-8: Draft 2 of HCR64

Report Title:

Requesting Congress to enact stronger energy policies

HOUSE OF REPRESENTATIVES TWENTY-FIRST LEGISLATURE, 2001 STATE OF HAWAII	H.C.R. NO.	64 H.D. 1
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HOUSE CONCURRENT RESOLUTION

requesting the United States Congress to enact stronger energy policies that will improve energy efficiency, develop and encourage renewable energy, reduce gasoline consumption for transportation, and switch from fossil fuels to alternative fuels.

WHEREAS, an Intergovernmental Panel on Climate Change report released on January 1, 2001 stated that, "An increasing body of observations gives a collective picture of a warming world and other changes in the climate system"; and

WHEREAS, this report builds on past assessments of climate data and incorporates new analysis that provides further evidence of global climate change attributable to human emissions of greenhouse gases; and

WHEREAS, the most certain method to address human effects on global climate is to curb emissions of greenhouse gases through extensive use of renewable energy sources, energy conservation, and energy efficiency; and

WHEREAS, the Federal government has not dedicated resources towards these methods to curb greenhouse gas emissions on a scale commensurate with the problem of climate change; and

WHEREAS, President Bush's recent decision to not regulate carbon dioxide emissions further deviates from policies that address the problem of climate change; and

WHEREAS, with 4% of the world's population but 25% of global greenhouse gas production, the United States has moral and ethical obligations to our future citizens and also to other nations to address the problem of climate change; and

WHEREAS, recent criticism from European Union nations about President Bush's commitment to addressing climate change underscores the fact that this issue affects national interests; and

WHEREAS, the United States must consider a national energy policy that diversifies our energy supplies to shield consumers from price spikes, reduce our over-reliance on polluting fossil fuels, and promotes much more aggressively the use of clean renewable energy and energy efficient resources; and

WHEREAS, the U.S. Department of Energy has proposed a field experiment involving the injection of 40 to 60 metric tons of liquefied carbon dioxide into the ocean at the Natural Energy Laboratory of Hawaii Authority Research Corridor located in Kona, Hawaii; and

WHEREAS, numerous concerned citizens have raised legitimate concerns over the environmental impact of this carbon dioxide ocean sequestration experiment including, but not limited to, changes in seawater chemistry and effects on marine organisms in the vicinity of the experiment; and

WHEREAS, one of the stated goals of the Department of Energy's Carbon Sequestration Program is to develop sequestration practices that do not introduce any new environmental problems; now, therefore,

BE IT RESOLVED by the House of Representatives of the Twenty-first Legislature of the State of Hawaii, Regular Session of 2001, requests that the United States Congress enact stronger energy policies that will improve energy efficiency, develop and encourage renewable energy, reduce gasoline consumption for transportation, and switch from fossil fuels to alternative fuels; and

BE IT FURTHER RESOLVED that the proponents of the carbon dioxide ocean sequestration experiment must address and disclose all concerns, potential impacts, and mitigative measures in environmental documents required under all applicable environmental laws and regulations, including but not limited to the National Environmental Policy Act; and

BE IT FURTHER RESOLVED that certified copies of this Concurrent Resolution be transmitted to the President of the United States, the U.S. Secretary of Energy, the Hawaii Congressional Delegation, the Director of the Department of Business, Economic Development, and Tourism, the Office of Environmental Quality Control, the Natural Energy Laboratory of Hawaii Authority, and the Pacific International Center for High Technology Research.

Document J-9: Report of Senate Committee on Water, Land, Energy and Environment

STAND. COM. REP. NO. 1700
Honolulu, Hawaii
, 2001

Honorable Robert Bunda
President of the Senate
Twenty-First State Legislature
Regular Session of 2001
State of Hawaii

Sir:

Your Committee on Water, Land, Energy and Environment, to which was referred H.C.R. No. 64, H.D. 1, entitled:

"HOUSE CONCURRENT RESOLUTION REQUESTING THE UNITED STATES CONGRESS TO ENACT STRONGER ENERGY POLICIES THAT WILL IMPROVE ENERGY EFFICIENCY, DEVELOP AND ENCOURAGE RENEWABLE ENERGY, REDUCE GASOLINE CONSUMPTION FOR TRANSPORTATION, AND SWITCH FROM FOSSIL FUELS TO ALTERNATIVE FUELS,"

begs leave to report as follows:

The purposes of this measure are to:

- (1) Request that the U.S. Congress enact stronger energy policies that will improve energy efficiency, develop and encourage renewable energy, reduce gasoline consumption for transportation, and switch from fossil fuels to alternative fuels; and
- (2) Require proponents of the carbon dioxide ocean sequestration experiment to address and disclose all concerns, potential impacts, and mitigating measures in environmental documents required under all applicable environmental laws and regulations, including but not limited to the National Environmental Policy Act.

Testimony in support of this measure was received from Kahea – The Hawaiian Environmental Alliance and fourteen individuals.

Your Committee finds that this is an issue of great concern to a broad segment of the public and the scientific community, as well. Further scrutiny of its many aspects is warranted to ensure that decisions made reflect these concerns.

Your Committee has amended this measure to add:

- (1) Language on the need for an Environmental Impact Statement on the concerns raised by citizens;
- (2) Missing language, "the Senate concurring," to the first BE IT RESOLVED clause;
- (3) Language on the public hearing process to the first BE IT FURTHER RESOLVED clause; and
- (4) The Director of Health to the list of parties receiving a certified copy of the Concurrent Resolution.

As affirmed by the record of votes of the members of your Committee on Water, Land, Energy and Environment that is attached to this report, your Committee concurs with the intent and purpose of H.C.R. No. 64, H.D. 1, as amended herein, and recommends its adoption in the form attached hereto as H.C.R. No. 64, H.D. 1, S.D. 1.

Respectfully submitted on behalf of
the members of the Committee on
Water, Land, Energy and
Environment,

Lorraine R. Inouye, Chair

Document J-10: Draft 3 of HCR64 (as redrafted by Senate Committee on Water, Land, Energy and Environment)

Report Title:

Requesting Congress to enact stronger energy policies

HOUSE OF REPRESENTATIVES TWENTY-FIRST LEGISLATURE, 2001 STATE OF HAWAII	H.C.R. NO.	64 H.D. 1 S.D. 1
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HOUSE CONCURRENT RESOLUTION

REQUESTING THE UNITED STATES CONGRESS TO ENACT STRONGER ENERGY POLICIES THAT WILL IMPROVE ENERGY EFFICIENCY, DEVELOP AND ENCOURAGE RENEWABLE ENERGY, REDUCE GASOLINE CONSUMPTION FOR TRANSPORTATION, AND SWITCH FROM FOSSIL FUELS TO ALTERNATIVE FUELS.

WHEREAS, an Intergovernmental Panel on Climate Change report released on January 1, 2001 stated that, "An increasing body of observations gives a collective picture of a warming world and other changes in the climate system"; and

WHEREAS, this report builds on past assessments of climate data and incorporates new analysis that provides further evidence of global climate change attributable to human emissions of greenhouse gases; and

WHEREAS, the most certain method to address human effects on global climate is to curb emissions of greenhouse gases through extensive use of renewable energy sources, energy conservation, and energy efficiency; and

WHEREAS, the Federal government has not dedicated resources towards these methods to curb greenhouse gas emissions on a scale commensurate with the problem of climate change; and

WHEREAS, President Bush's recent decision to not regulate carbon dioxide emissions further deviates from policies that address the problem of climate change; and

WHEREAS, with four percent of the world's population but twenty-five percent of global greenhouse gas production, the United States has moral and ethical obligations to our future citizens and also to other nations to address the problem of climate change; and

WHEREAS, recent criticism from European Union nations about President Bush's commitment to addressing climate change underscores the fact that this issue affects national interests; and

WHEREAS, the United States must consider a national energy policy that diversifies our energy supplies to shield consumers from price spikes, reduce our over-reliance on polluting fossil fuels, and promotes much more aggressively the use of clean renewable energy and energy efficient resources; and

WHEREAS, the U.S. Department of Energy has proposed a field experiment involving the injection of forty to sixty metric tons of liquefied carbon dioxide into the ocean at the Natural Energy Laboratory of Hawaii Authority Research Corridor located in Kona, Hawaii; and

WHEREAS, numerous concerned citizens have raised legitimate concerns over the environmental impact of this carbon dioxide ocean sequestration experiment including, but not limited to, changes in seawater chemistry, effects on marine organisms in the vicinity of the experiment, and the need for an Environmental Impact Statement; and

WHEREAS, one of the stated goals of the U.S. Department of Energy's Carbon Sequestration Program is to develop sequestration practices that do not introduce any new environmental problems; now, therefore,

BE IT RESOLVED by the House of Representatives of the Twenty-First Legislature of the State of Hawaii, Regular Session of 2001, the Senate concurring, that the United States Congress is requested to enact stronger energy policies that will improve energy efficiency, develop and encourage renewable energy, reduce gasoline consumption for transportation, and switch from fossil fuels to alternative fuels; and

BE IT FURTHER RESOLVED that the proponents of the carbon dioxide ocean sequestration experiment must address and disclose, through the public hearing process, all concerns, potential impacts, and mitigating measures in environmental documents required under all applicable environmental laws and regulations, including but not limited to the National Environmental Policy Act; and

BE IT FURTHER RESOLVED that certified copies of this Concurrent Resolution be transmitted to the President of the United States, the U.S. Secretary of Energy, the Hawaii Congressional Delegation, the Director of Business, Economic Development, and Tourism, the Director of Health, the Office of Environmental Quality Control, the Natural Energy Laboratory of Hawaii Authority, and the Pacific International Center for High Technology Research.

Appendix K: Unsuccessful Legislative Resolutions

Source: Hawaii State Legislature [Internet], Honolulu (HI): Status and Documents; [cited May 8, 2002]. Available from:
<http://www.capitol.hawaii.gov/site1/archives/2001/default.asp?press1=archives>.

Summary of Documents

The following documents provide a summary of the legislative history for three unsuccessful resolutions in the Hawaii State Legislature.

SCR158

- Document 1 is a backgrounder on SCR158.
- Document 2 provides a chronology of events for SCR158
- Document 3 is a draft of the resolution, as introduced by Senators Matsuura, Kokubun, English, Chun Oakland, Tam, Buen, Kawamoto, Hanabusa, Nakata, Kim, Sakamoto, Chumbley, and Kanno.

SCR125

- Document 4 is a backgrounder on SCR125.
- Document 5 provides a chronology of events for SCR125.
- Document 6 is a draft of the resolution, as introduced by Senators Inouye, English, and Hemmings.

HR33/HCR28

- Document 7 is a backgrounder on HR33/HCR28.
- Document 8 provides a chronology of events for HR33.
- Document 9 is a draft of HR33, as introduced by Representatives Rath and Whalen.
- Document 10 provides a chronology of events for HCR28. Note that the contents are the same as Document 7, but the resolution received a new title after being re-referred by committee.
- Document 11 is a draft of HCR28, as introduced by Representatives Rath and Whalen. Note that the contents are the same as Document 8, but the title is different.

Document K-1: Backgrounder on SCR158	183
Document K-2: Status Report Summarizing History of SCR158	185
Document K-3: Draft of SCR158	187
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Document K-1: Backgrounder on SCR158

Senate Concurrent Resolution No. 158 was a resolution that supported the experiment. It was sponsored by Senators David Matsuura, Russell Kokubun, and J. Kalani English; ten other senators also signed the measure. Matsuura and Kokubun are the other two senators from the big island. The measure resolved that atmospheric carbon dioxide was of deep concern to Hawaii, that the efforts to address the issue through an ocean study were strongly supported, and that Hawaii would provide resources and cooperation to curb the threat of global warming. SCR158 was referred to the Senate Economic Development and Technology Committee and Water, Land, Energy and the Environment Committee.

Interestingly, Senator Inouye was chair of the Water, Land, Energy and the Environment Committee, and Kokubun was chair of the Economic Development and Technology Committee. SCR125 and SCR158 opposed each other, and needed to clear both committees. In the end, no action was taken on either measure, and both resolutions died.

Document K-2: Status Report Summarizing History of SCR158

**Hawaii State Legislature
2001 Regular Session**

SCR158

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Measure Title: SUPPORTING RESEARCH AND OTHER EFFORTS TO
COUNTER GLOBAL WARMING.

Report Title: CO2 Emissions; Sequestrian of CO2 Experiment

Description:

Package: None

Companion:

Introducer(s): MATSUURA, KOKUBUN, ENGLISH, Chun Oakland, Tam, Buen,
Kawamoto, Hanabusa, Nakata, Kim, Sakamoto, Chumbley, Kanno

Current Referral: WLE, EDT

Date		Status Text
3/14/01	S	Offered.
3/16/01	S	Referred to EDT, WLE.
3/28/01	S	Re-Referred to WLE, EDT.

Document K-3: Draft of SCR158

Report Title:

CO2 Emissions; Sequestration of CO2 Experiment

THE SENATE TWENTY-FIRST LEGISLATURE, 2001 STATE OF HAWAII	S.C.R. NO.	158
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SENATE CONCURRENT RESOLUTION

supporting research and other efforts to counter global warming.

WHEREAS, the amount of carbon dioxide (CO₂) emitted into the atmosphere has greatly increased over the past decades, primarily as a result of burning fossil fuels worldwide; and

WHEREAS, atmospheric CO₂ is a greenhouse gas that has the ability to absorb the energy radiated or reflected from the Earth, thus acting as a thermal blanket; and

WHEREAS, growing scientific evidence suggests that increased atmospheric concentrations of greenhouse gases could trigger widespread climatic change and other serious environmental consequences, collectively known as Global Warming; and

WHEREAS, the State of Hawaii would be gravely exposed to some potential effects of Global Warming, such as sea level rise, changes in the frequency and strength of severe storms and loss of bio-diversity; and

WHEREAS, international treaties such as the United Nations' Framework Convention on Climate Change (FCCC) and the Kyoto Protocol call for industrialized nations to sharply reduce their greenhouse gas emissions; and

WHEREAS, the United States is a signatory of both the FCCC, which was ratified, and the Kyoto Protocol; and

WHEREAS, the Climate Technology Initiative (CTI) was established in 1995 by the International Energy Agency (IEA) to enhance the use of existing and new climate-friendly technologies through international collaboration in research, development, deployment and information dissemination; and

WHEREAS, improvements in the efficiency of energy use, the substitution of lower-carbon fuels, and the development of renewable sources of energy represent preferable approaches to reduce man-made emissions of CO₂ into the atmosphere; and

WHEREAS, the worldwide use of fossil fuels in developing and developed countries, with forecasts of a growing global population, is nevertheless expected to increase sharply in this century; and

WHEREAS, the United States is the largest producer of atmospheric CO₂; and

WHEREAS, other possible technologies that have been conceptually outlined to reduce atmospheric concentrations of greenhouse gases in the atmosphere should be evaluated in a rigorously scientific fashion; several of these technologies are based on the separation and disposal (sequestration) of anthropogenic CO₂ into natural reservoirs other than the atmosphere; and,

WHEREAS, one sequestration technology calls for the disposal of anthropogenic CO₂ into the deep ocean (ocean carbon sequestration); and

WHEREAS, the deep ocean has by far the largest capacity to act as a carbon reservoir; and

WHEREAS, most of the excess atmospheric CO₂ will be transferred to the deep ocean via slow natural phenomena over several centuries, limited by the laws of physics and chemistry; and

WHEREAS, in December 1997, the Governments of the United States, Japan, and Norway signed an international project agreement under the CTI; the project was defined as an ocean field experiment aimed at advancing the scientific knowledge pertaining to ocean carbon sequestration; and

WHEREAS, the Governments of Canada and Australia, as well as ABB of Switzerland and CRIEPI of Japan later joined the aforementioned international project agreement calling for a Sequestration of CO₂ Field Experiment; and

WHEREAS, the University of Hawaii is a key participant in the Sequestration of CO₂ Field Experiment; and

WHEREAS, the Pacific International Center for High Technology Research (PICHTR), based in Honolulu, was selected as the general contractor for the Sequestration of CO₂ Field Experiment; and

WHEREAS, the Sequestration of CO₂ Field Experiment is a small-scale, short-term project to be conducted at a depth of approximately one-half mile or more in the deep ocean surrounding Hawaii, and will collect valuable scientific information needed to better evaluate the effectiveness and potential environmental effects of ocean carbon sequestration; and

WHEREAS, extensive laboratory tests and computer simulations have been conducted for many years by scientists in the participating countries, and the collective judgment of the international group is that the experiments as designed will have only minimal and transient effects on the ocean environment as documented in the Environmental Assessment; and

WHEREAS, manned and unmanned deep water submersibles together with fixed underwater instrumentation will monitor the experiments and gather invaluable scientific data to fine tune the computer models for future studies; and

WHEREAS, Hawaii was selected to host the two-week long Sequestration of CO₂ Field Experiment, based on very favorable bathymetric and other environmental data; and

WHEREAS, conducting the Sequestration of CO₂ Field Experiment in Hawaii will contribute to Hawaii's role as a center for climate change research, where other important international collaborations are already taking place, especially at the University of Hawaii; and

WHEREAS, the safety and well-being of future generations in Hawaii and world wide may be seriously threatened by Global Warming unless the effects of atmospheric CO₂ are mitigated; now, therefore,

BE IT RESOLVED by the Senate of the Twenty-First Legislature of the State of Hawaii, Regular Session of 2001, the House of Representatives concurring, the effects of increasing atmospheric CO₂ on the people and environment of our State is of deep concern, particularly Global Warming; and

BE IT FURTHER RESOLVED that the efforts of the Governments of the United States, Japan, Norway, Canada, and Australia to seriously address these issues by conducting a scientifically sound and environmentally safe study of CO₂ Sequestration in the deep ocean are strongly supported; and

BE IT FURTHER RESOLVED that the resources and cooperation of the State of Hawaii shall be made available to contribute, in conformance with the laws of State of Hawaii, to this worthy international effort to curb the threat of Global Warming for the safety and well being of future generations of our people; and

BE IT FURTHER RESOLVED that certified copies of this Concurrent Resolution be transmitted to the Governor and the Natural Energy Laboratory of Hawaii Authority.

OFFERED BY: _____

Document K-4: Backgrounder on SCR125

Senators Lorraine Inouye, J. Kalani English and Fred Hemmings introduced Senate Concurrent Resolution No. 125 on March 15, 2001. Inouye is one of three senators from the big island of Hawaii. The measure resolved to oppose any resumption of the proposal to conduct carbon dioxide experiments off the Kona coast, and was virtually identical to the first draft of HR64/HCR64. The measure was referred to the Senate Economic Development and Technology Committee as well as the Water, Land, Energy and the Environment Committee and Agriculture Committee. The measure died in committee.

Document K-5: Status Report Summarizing History of SCR125

**Hawaii State Legislature
2001 Regular Session**

SCR125

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Measure Title: OPPOSING ANY RESUMPTION OF THE PROPOSAL TO CONDUCT CARBON DIOXIDE EXPERIMENTS OFF THE KONA COAST.

Report Title: Oppose Carbon Dioxide Experiments off Kona Coast

Description:

Package: None

Companion:

Introducer(s): INOUYE, English, Hemmings

Current Referral: EDT/WLE/AGT

Date		Status Text
3/15/01	S	Offered.
3/16/01	S	Referred to EDT, WLE/AGT.
3/29/01	S	Re-Referred to EDT/WLE/AGT.

Document K-6: Draft of SCR125

Report Title:

Oppose Carbon Dioxide Experiments off Kona Coast

THE SENATE
TWENTY-FIRST LEGISLATURE, 2001
STATE OF HAWAII

S.C.R. NO. 125

SENATE CONCURRENT RESOLUTION

opposing any resumption of the proposal to conduct carbon dioxide experiments off the Kona coast.

WHEREAS, the Board of Directors of the Natural Energy Laboratory of Hawaii Authority (NELHA) recently voted to exclude an experiment with carbon dioxide from its Kona waters; and

WHEREAS, the NELHA board had earlier given a preliminary approval to the experiment on carbon dioxide "sequestration," or the locking of carbon dioxide in ocean water; and

WHEREAS, the experiment, under the direction of the Pacific International Center for High Technology Research, would pump small amounts of liquefied carbon dioxide two hours at a time, increasing to 7.6 metric tons in two hours; and

WHEREAS, scientists anticipate that a plume of droplets would rise and dissolve in the water and the droplets would turn the water in the fifty-foot-wide plume from its normal slight alkalinity to a slight acidity, and that the effects could last six to twelve hours; and

WHEREAS, the purpose of the experiment is to determine exactly how big the plume is, how acidic, and how long it lasts; and

WHEREAS, the NELHA board, however, voted against this experiment in its final form because of concerns about its scientific merits, possible legal ramifications, a change in scope, general public opposition, and opposition by the Keahole Point Tenants Association; and

WHEREAS, opponents quoted the Union of Concerned Scientists, which said ocean sequestration is untested and that it must be carefully studied; and

WHEREAS, research groups have used this same argument to press for testing; and

WHEREAS, the NELHA exclusion applies only to a defined area of ocean at Keahole Point about two miles wide and 2.6 miles out to sea; and

WHEREAS, the experiment might still be done in the general area, perhaps outside the State's 3-mile-wide territorial waters; now, therefore,

BE IT RESOLVED by the Senate of the Twenty-First Legislature of the State of Hawaii, Regular Session of 2001, the House of Representatives concurring, that the Legislature states its opposition to any resumption of the proposal to conduct carbon dioxide experiments in Hawaiian waters; and

BE IT FURTHER RESOLVED that certified copies of this Concurrent Resolution be transmitted to the Board of Directors of the Natural Energy Laboratory of Hawaii Authority and to the Board of Directors of the Pacific International Center for High Technology Research.

OFFERED BY: _____

Document K-7: Backgrounder on HR33/HCR28

Representatives Jim Rath and Paul Whalen introduced House Resolution No. 33/House Concurrent Resolution No. 28 on February 22, 2001. Rath represented the district where the sequestration experiment was to be conducted and Whalen represented the neighboring district.

The resolution requested that the Hawaii Department of Health deny a National Pollution Discharge Elimination System (“NPDES”) permit waiver for the project for several reasons, including: (1) the presence of ocean currents in the area would make it improbable that the material would stay on the seabed within the confines of the NELHA research corridor; (2) the carbon dioxide would create a sterile seabed; and (3) a large volume of published material indicating community feelings on the experiment as unwise, ill-considered, and unwanted.

NPDES was established by the U.S. Environmental Protection Agency (“EPA”) in 1972 as part of the Federal Water Pollution Control Act Amendments. In most cases, NPDES permits are administered by the states, as is the case in Hawaii. Under the program, all facilities, which discharge pollutants from any point source into waters of the United States, are required to obtain a NPDES permit. According to Bruce Anderson, Director of the Hawaii Department of Health, the project would need to apply for a NPDES permit “if it planned to discharge anything within three miles of the shore.” Beyond three miles would be the responsibility of the EPA.⁹⁶

The NPDES waiver allows certain short-term releases of pollution without a permit if the project can meet certain conditions. The measure was offered on March 1,

⁹⁶ B. Command, “Panel Approves CO₂ Plan,” *West Hawaii Today* [Internet] February 16, 2001; [cited April 25, 2002]. Available from: <http://www.westhawaii.com/daily/2001/Feb-16-Fri-2001/news/news1.html>.

2001. It was subsequently referred to the House Energy and Environmental Protection Committee and Higher Education Committee. The measure died after being re-referred to the House Energy and Environmental Protection Committee on March 14, 2001.

Document K-8: Status Report Summarizing History of HR33

**Hawaii State Legislature
2001 Regular Session**

HR33

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Measure Title: REQUESTING THAT THE DEPARTMENT OF HEALTH DENY A NPDES PERMIT WAIVER FOR EXPERIMENTS BY THE PACIFIC INTERNATIONAL CENTER FOR HIGH TECHNOLOGY TO INJECT 63 TONS OF LIQUID CARBON DIOXIDE INTO THE OCEAN OFF THE NELHA SITE ON KEAHOLE POINT.

Report Title: Deep Ocean CO2 Sequestration

Description:

Package: None

Companion: HCR28

Introducer(s): RATH, WHALEN

Current Referral: EEP

Date		Status Text
2/22/01	H	Filed.
3/1/01	H	Offered
3/2/01	H	Referred to the committees on EEP, HED, referral sheet 27.
3/14/01	H	Re-referral to the committee on EEP, referral sheet 31.

Document K-9: Draft of HR33

Report Title:

Deep Ocean CO2 Sequestration

HOUSE OF REPRESENTATIVES TWENTY-FIRST LEGISLATURE, 2001 STATE OF HAWAII	H.R. NO.	33
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HOUSE CONCURRENT RESOLUTION

Requesting that the department of health deny a Npdes permit waiver for experiments by the Pacific international center for high technology to inject 63 tons of liquid carbon dioxide into the ocean off the NELHA site on Keahole point.

WHEREAS, The Pacific International Center for High Technology, in conjunction with the New Energy and Industrial Technology Development Organization of Japan and the Research Council of Norway have undertaken preliminary steps to obtain permit waivers from the Hawaii Department of Health which would allow them to deposit carbon dioxide converted into a liquid phase called clathrate hydrate on the ocean floor off Keahole Point; and

WHEREAS, the amount of this discharge is to be 63 tons of material deposited over a two week period; and

WHEREAS, the presence of ocean currents in the area in excess of 1.6 knots makes it improbable that the material will stay on the seabed at 2600 feet within the confines of the NELHA research corridor where it is deposited; and

WHEREAS, carbon dioxide is highly reactive to seawater and would acidify the ocean and create a sterile seabed in close proximity to a productive fishing ground and a National Whale Sanctuary; and

WHEREAS, the potential impacts of ocean sequestration of carbon dioxide on deep ocean ecosystems are almost entirely uninvestigated; and

WHEREAS, the large volume of published material speaking against this experiment indicates strong community feelings that this experiment is unwise, ill-considered, and unwanted; and

WHEREAS, the Board of Directors of NELHA voted on February 20, 2001 to reject the use of the experimental corridor proposed by the Pacific International Center for High Technology; and

WHEREAS, in situ experiments of carbon injection into oceans have shed considerable doubt on the possibility of "permanent" carbon sequestration, as conditions for hydrate stability are extremely difficult to maintain and carbon plumes would be released into the upper ocean and subjected to its currents resulting in direct toxicity of high CO₂ concentrations to marine life; now, therefore,

BE IT RESOLVED by the House of Representatives of the Twenty-first Legislature of the State of Hawaii, Regular Session of 2001, that the Department of Health is requested to deny to the Pacific International Center for High Technology a waiver of National Pollution Discharge Elimination System Permit which allows a discharge of pollutants such as CO₂ and would be necessary to complete this experiment; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the Director of the Department of Health.

OFFERED BY: _____

Document K-10: Status Report Summarizing History of HCR28

**Hawaii State Legislature
2001 Regular Session**

HCR28

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Measure Title: REQUESTING THAT THE DEPARTMENT OF HEALTH DENY A NPDES PERMIT WAIVER FOR EXPERIMENTS BY THE PACIFIC INTERNATIONAL CENTER FOR HIGH TECHNOLOGY TO INJECT 63 TONS OF LIQUID CARBON DIOXIDE INTO THE OCEAN OFF THE NELHA SITE ON KEAHOLE POINT.

Report Title: Deep ocean CO2 sequestration

Description:

Package: None

Companion: HR33

Introducer(s): RATH, WHALEN

Current Referral: EEP

Date		Status Text
2/22/01	H	Filed.
3/1/01	H	Offered
3/2/01	H	Referred to the committees on EEP, HED, referral sheet 27.
3/14/01	H	Re-referral to the committee on EEP, referral sheet 31.

Document K-11: Draft of HCR28

Report Title:

Deep ocean CO2 sequestration

HOUSE OF REPRESENTATIVES
TWENTY-FIRST LEGISLATURE, 2001
STATE OF HAWAII

H.C.R. NO. 28

HOUSE CONCURRENT RESOLUTION

Requesting that the department of health deny a Npdes permit waiver for experiments by the Pacific international center for high technology to inject 63 tons of liquid carbon dioxide into the ocean off the NELHA site on Keahole point.

WHEREAS, The Pacific International Center for High Technology, in conjunction with the New Energy and Industrial Technology Development Organization of Japan and the Research Council of Norway have undertaken preliminary steps to obtain permit waivers from the Hawaii Department of Health which would allow them to deposit carbon dioxide converted into a liquid phase called clathrate hydrate on the ocean floor off Keahole Point; and

WHEREAS, the amount of this discharge is to be 63 tons of material deposited over a two week period; and

WHEREAS, the presence of ocean currents in the area in excess of 1.6 knots makes it improbable that the material will stay on the seabed at 2600 feet within the confines of the NELHA research corridor where it is deposited; and

WHEREAS, carbon dioxide is highly reactive to seawater and would acidify the ocean and create a sterile seabed in close proximity to a productive fishing ground and a National Whale Sanctuary; and

WHEREAS, the potential impacts of ocean sequestration of carbon dioxide on deep ocean ecosystems are almost entirely uninvestigated; and

WHEREAS, the large volume of published material speaking against this experiment indicates strong community feelings that this experiment is unwise, ill-considered, and unwanted; and

WHEREAS, the Board of Directors of NELHA voted on February 20, 2001 to reject the use of the experimental corridor proposed by the Pacific International Center for High Technology; and

WHEREAS, in situ experiments of carbon injection into oceans have shed considerable doubt on the possibility of "permanent" carbon sequestration, as conditions for hydrate stability are extremely difficult to maintain and carbon plumes would be released into the upper ocean and subjected to its currents resulting in direct toxicity of high CO₂ concentrations to marine life; now, therefore,

BE IT RESOLVED by the House of Representatives of the Twenty-first Legislature of the State of Hawaii, Regular Session of 2001, the Senate concurring, that the Department of Health is requested to deny to the Pacific International Center for High Technology a waiver of National Pollution Discharge Elimination System Permit which allows a discharge of pollutants such as CO₂ and would be necessary to complete this experiment; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the Director of the Department of Health.

OFFERED BY: _____

Appendix L: Finding of No Significant Impact

Finding of No Significant Impact, DOE Participation in the Ocean Sequestration CO₂ Field Experiment

Source: U.S. Department of Energy

FINDING OF NO SIGNIFICANT IMPACT

DOE PARTICIPATION IN THE OCEAN SEQUESTRATION OF CO₂ FIELD EXPERIMENT

AGENCY: U.S. Department of Energy (DOE)

ACTION: Finding of No Significant Impact

SUMMARY: DOE has prepared an Environmental Assessment (EA), DOE/EA-1336, titled *Ocean Sequestration of CO₂ Field Experiment*, to analyze the potential environmental consequences of participating in an experiment to test the dissolution and dispersion of liquid carbon dioxide in ocean water at moderate depth. The results of the analyses provided in the EA are summarized in this Finding of No Significant Impact (FONSI).

The ocean sequestration experiment would be conducted as a joint international effort, with involvement by the governments of Australia, Canada, Japan, and Norway and the participation of private entities, such as Asea Brown Boveri (ABB) and the Central Research Institute of Electric Power Industry (CRIEPI) in Japan. DOE would participate in the implementation and administration of the experiment through representation on a steering committee responsible for overall direction and scope of the experiment and for oversight of the planning and conduct of experimental activities. DOE would provide funds for development of experimental plans, public outreach, permitting, data analysis, modeling predictions, and other support functions; the DOE finding would equate to about 20% of the total estimated cost of the experiment.

The primary purpose of the *Field Experiment* would be to develop the data needed to verify scientific principles and to test, validate, and refine computer models used for predicting the behavior of carbon dioxide released into the ocean at moderate depth. Specific technical objectives of the experiment include the following:

- Investigating the dynamics of a cloud of liquid CO₂ droplets with varying droplet sizes and released at varying velocities
- Tracing the evolution of carbon-enriched seawater resulting from dissolution of the CO₂ droplets
- Examining both the effects that hydrate formation might have on dissolution of the CO₂ droplets and the effects on seawater acidity within and on the margins of the droplet plume
- Establishing the effects of the experiment on bacterial biomass, production, and growth efficiency due to induced changes in seawater acidity

Information obtained from the experiment would be used, if needed, for future policy decisions on the viability of ocean sequestration as an option to mitigate potential effects (climate change) caused by carbon dioxide build-up in the atmosphere, which results primarily from combustion of fossil energy sources. Information developed from the

experiment would complement other DOE sponsored research on approaches with potential for managing increases in atmospheric levels of carbon dioxide, such as geologic or terrestrial sequestration, recovery and use, efficiency improvements in energy production and use, and use of alternative energy sources. Ocean sequestration of carbon dioxide would complement natural processes that occur at the ocean surface, where carbon dioxide gas from the atmosphere dissolve into seawater and is eventually transported and dispersed into deeper layers of the oceans. The experiment would also enable parties studying global climate change to gain an improved understanding of CO₂ dispersion in the ocean. Data generated from observations of dispersal and mixing would enable tuning of oceanographic models for improved representation of the effects of ocean turbulence.

Based on the analyses in the EA, DOE has concluded that the carbon sequestration experiment will result in minimal and insignificant consequences to the human environment. Thus, DOE considers that the proposed action, for participation with a group of friendly nations and private entities in the conduct of the experiment, is not a major Federal action significantly affecting the quality of the human environment, within the meaning of the National Environmental Policy Act (NEPA) of 1969, 42 United States Code 4321, *et seq.*

DOE has, however, identified several additional measures beyond those incorporated into the EA, including adjustments to the experimental plan, to decrease the perceived risks and expressed public concerns regarding the potential consequences of the experiment on the human environment. Those additional measures are identified as commitments in this FONSI and, pursuant to Title 10, Code of Federal Regulations (CFR), Part 1021.33 1, have been incorporated into a Mitigation Action Plan. Therefore, in accordance with 10 CFR Part 1021.322, DOE has concluded that preparation of an Environmental Impact Statement is not required, and DOE is issuing this FONSI.

COPIES OF THE EA ARE AVAILABLE FROM:

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BACKGROUND: In 1997, DOE signed an agreement with parties representing the governments of Japan and Norway for international collaboration to determine the technical feasibility and to improve understanding of the environmental impacts of CO₂ ocean sequestration, in order to advance knowledge on the behavior of CO₂ release in the ocean. Subsequently, additional parties representing Canada and Australia and private entities ABB and CREIPI have joined the agreement, which provides for a steering committee, consisting of one representative from each party, to manage the overall direction and scope of the effort. A technical committee, comprised of representatives from the implementing organizations of the participating countries, was also established to formulate and execute annual work plans.

The implementing organization for Government of Japan – the Research Institute of Innovative Technology for the Earth, as part of its contribution to the proposed experiment, contracted with the Pacific International Center for High Technology Research based in Honolulu, HI, to establish the infrastructure required for the experiment. DOE participates on the steering committee and provides support for public outreach, permitting, and conceptual planning. DOE's funding constitutes approximately 20% of the estimated total funding for conduct of the experiment and for supporting activities.

From inception of the international agreement through 1999, ideas and concepts for ocean sequestration and appropriate seawater and site conditions for the conduct of a research experiment were examined. Test releases of CO₂ would need to occur at a minimum depth of 800 meters to adequately evaluate the ocean sequestration concept, and ocean locations with reasonable proximity to land and relatively calm weather and surface wave conditions were considered to be logistically important. In January 2000, following progress on concept definition to the point of adequacy for environmental analysis, DOE issued a determination to prepare an Environmental Assessment for use in decision-making regarding the potential consequences to the human environment that might result from participation in the experiment.

PUBLIC PARTICIPATION: On August 8, 2000, DOE released a draft Environmental Assessment for review and comment. Alternatives analyzed in the EA included alternative locations, consisting of a site offshore from the western coast of the Island of Hawaii, a different (generic) ocean site possessing comparable characteristics within or beyond Hawaiian waters, and No Action. The EA was provided to Federal and State of Hawaii agencies and to the public for review and comment; copies were made available for review at libraries of the Islands of Hawaii and Oahu and in DOE public reading rooms.

Public notices announcing availability of the draft EA were placed in the Hawaii Tribune Herald and West Hawaii Today newspapers on the Island of Hawaii and in The Honolulu Advertiser on the Island of Oahu. Announcements were also placed on a DOE web site (www.netl.doe.gov), on a web site (www.co2experiment.org) established to disseminate project-related information, and in a journal published by Hawaii's Office of

Environmental Quality Control to announce plans and results of environmental studies for proposed projects in Hawaii.

Following a 30-day review and comment period, additional analyses and studies were performed, which culminated in release of the Final Environmental Assessment in March 2001.

DESCRIPTION OF THE PROPOSED ACTION: The proposed action is for DOE to participate with a group of international organizations in a research experiment to test and evaluate the dispersion and dissolution of liquid carbon dioxide released into the ocean water of moderate depth.

To achieve experimental objectives, a preliminary experimental plan was prepared; this plan was included in the EA. The experimental plan would provide for a maximum (If twenty intermittent, 2-hour tests, during which liquid carbon dioxide would be pumped from a tank on a surface vessel through flexible tubing to a release nozzle attached to a platform previously lowered from the surface vessel to the ocean floor, at a depth of about 800 meters. A cumulative total (maximum) of sixty tons (about 15,500 gallons) of liquid carbon dioxide would be released in a sequential series of tests with release rates ranging from near zero to a maximum of about 16 gallons per minute (gpm).

Carbon dioxide would exit the nozzle as a cloud of discrete liquid droplets that, based on the physical characteristics of the droplets and the surrounding ocean water, would not be expected to rise more than 300 meters above the nozzle (i.e., to a minimum depth of 500 meters below the ocean surface). As the buoyant carbon dioxide droplets rise in the water column, they would dissolve into the surrounding water since the natural concentration of inorganic carbon in seawater is substantially below the solubility limit for carbon dioxide. The dissolution of CO₂ would create relatively dense, carbon-enriched seawater that would sink to a depth of neutral buoyancy through mixing with the ambient seawater. During this process, the droplet cloud and the carbon-enriched seawater would drift with the prevailing ocean current and be farther diluted by additional ocean mixing.

Due to the depth (water column pressure) and temperature of the ocean environment that would be experienced by the droplets between their release point and the point of maximum rise, the CO₂ would remain in liquid form. At the droplet surface, however, a coating termed a "hydrate," which is a complex between water and carbon dioxide, could form under certain conditions. This coating would slow the overall dissolution process. Experimental plans for CO₂ releases would be conducted to ensure that the droplets remain buoyant even with a hydrate coating.

Projections indicate that all surface vessel activity required to conduct the experiment could be completed within ten days, with only five days used for releases of CO₂. Deployment of equipment and sediment and water characterization would be conducted on the first day. Prior to the start of experimental activities on the second day, CO₂ would be released at a very small flow rate in order to test the remotely operated equipment planned for use in observing the CO₂ droplet rise. Subsequently, from day 2 through day

4, an initial series of seven tests would be conducted at the lowest planned CO₂ release rate of 1.6 gpm, and this would be followed by three tests at a release rate of 16 gpm. Day 5 would be used for sampling and observation and equipment changes, with no CO₂ flow. Following a nozzle change to produce droplets of a different size, four tests at a flow rate of 1.6 gpm would be followed by three tests at the higher release rate on days 6 and 7, which would mark the completion of the experimentation. Sampling and observation and retrieval of all underwater equipment would be performed on the following two days.

Monitoring of the released CO₂ droplets would be conducted using remotely operated vehicles, a manned submersible, and an array of bottom-mounted mid ocean instrumentation. Monitoring would be conducted to follow the lateral, vertical, and down current movement of the cloud of liquid droplets and the plume of carbon-rich water resulting from dissolution of the droplets. As the carbon dioxide dissolves into the ocean water, the acidity of the water would increase from an ambient pH level of about 7.6 at 800-meter depth. Predictions from computer modeling indicate that all ocean water affected by a release of CO₂ would have a pH level higher than 6.5 within three hours after a release has stopped, by which time the plume of carbon-enriched water would be transported about 550 meters down current from the release nozzle based on a prevailing current speed of 5 centimeters per second at the seafloor depth of 800 meters. Model predictions indicate that the pH of all affected water would return to the ambient level of 7.6 within about 12 hours.

The experimental activities would be reviewed and the environment conditions would be closely monitored for the purpose of implementing contingency measures whenever warranted. Contingency actions, ranging from alteration of experimental operations to suspension or termination of carbon dioxide release, would be triggered under the following conditions:

- Observation of unusual mortality of marine organisms collected for use and observation as test organisms; these organisms would be carried in traps attached to remotely operated vehicles that would traverse the plume of CO₂ droplets and carbon-enriched water for data collection;
- Observation of unusual mortality of fish, squid, or other free-swimming organisms in the water column;
- Observation of unusual mortality of benthic organisms;
- Observation of CO₂ droplets reaching the surface;
- Measurement of pH levels below 6.0 more than 100 meters from the release nozzle;
- Observation of threatened or endangered species in the vicinity of the release nozzle;
- Observation of significant numbers of sensitive species in the area potentially impacted by the experiment;
- Observation of large aggregations of organisms transiting the area in or near the CO₂ enriched water plume;

- Measured noise levels that are substantially higher than expected or observations that noise levels are affecting the behavior or macro fauna near the release platform; and
- Observations by shipboard spotters (If substantial aggregations of any threatened or endangered species.

ENVIRONMENTAL CONSEQUENCES: The Environmental Assessment included analyses of the potential impacts of the proposed *Ocean Sequestration of CO₂ Field Experiment* on the following elements (If the human and natural environment: water quality; marine resources; historic and cultural resources; air quality and climate; noise and vibration; transportation; land use; aesthetics; socioeconomics; public facilities and services; safety & health; biodiversity and environmentally sensitive resources; environmental justice; and pollution prevention.

The analyses identified that the most notable consequences of the experiment would result from the following activities or environmental changes: placement of experimental and monitoring equipment on the ocean floor; interactions of CO₂ with seawater, resulting in temporary increases in acidity; and the physical presence and movement of surface vessels required to support the proposed project. No substantive adverse impacts were identified from analyzing the effects of these changes.

WATER QUALITY:

During each test, the release nozzle would create an initial cloud of CO₂ droplets. Computer modeling indicates that this droplet cloud would initially rise to a maximum height of 60 to 120 meters above the release nozzle (to a point 740 to 680 meters below the ocean surface) due to the lower density of carbon dioxide liquid in relation to seawater. The droplet cloud would also spread laterally from the release point to a width of about 20 to 30 meters and would continue to move with the prevailing ocean current at the depth of the experiment, and the CO₂ would gradually dissolve into the ocean water.

Complete dissolution of the carbon dioxide droplets would occur within about 100 meters down current from the release nozzle. The resulting plume of carbon-enriched seawater would gradually dissipate with time, and the dissolution process would result in an increase in the acidity of the affected seawater from the ambient pH value of 7.6 at a depth of 800 meters. Computer models predict that pH levels of 6.5 or less would be expected to persist for no more than 3 hours after a CO₂ release is stopped, while the plume would have drifted down current for a distance of about 550 meters. The pH level of all water affected by a release of CO₂ would be expected to be at the level of the ambient water (pH = 7.6) within 12 hours.

Research vessels used for the experiment would manage bilge and ballast water to minimize pollution and the introduction of non-indigenous or exotic species into waters at the ocean site for the experiment.

MARINE RESOURCES:

Section 7(a)(2) of the Endangered Species Act directs Federal agencies to consult with the Department of the Interior to insure that any Federal action authorized, funded, or carried out is not likely to jeopardize the continued existence of any endangered or threatened species or to result in the destruction or adverse modification of the habitat of such species. The U.S. Department of the Interior/Fish & Wildlife (F&W) Service was consulted and confirmed that the proposed project would not be likely to result in any adverse effects on seabirds or Federally listed or State-protected animal or plant species under the jurisdiction of the F&W Service. The F&W Service did, however, provide suggestions and recommendations for further assuring that adverse effects would not result, and mitigation measures appropriate for addressing those recommendations will be incorporated into the plans for the proposed project.

Consultation with the U.S. Department of Commerce, National Marine Fisheries Service (NMFS), regarding marine mammals and protected species confirmed that the small-scale nature of the proposed experiment would not be likely to adversely affect marine mammals and threatened or endangered species or their critical habitat. The NMFS did, however, provide recommendations for further assuring that the experiment would not adversely affect marine mammals, and mitigation measures appropriate for addressing those recommendations will be incorporated into project plans.

The EA analyzed the potential consequences that would result from ten deployments of the CO₂ discharge equipment. Deployment and movement of equipment required for the experiment would be expected to produce some abrasion of the seafloor at the site of the experiment. While the experiment would be conducted at a site with an absence of coral resources, a potential for stress and mortality on benthic life beneath experimental equipment would be anticipated. Each equipment deployment would be expected to result in potential for abrasion of 0.4 square meters of seafloor from the nozzle platform and 1.8 acres from the discharge tubing. The small size of the equipment contact area would result in insignificant adverse effect on benthic marine life. Current projections indicate that two deployments of the discharge equipment could be sufficient for collection of all needed experimental research data; this limitation on the number of deployments for nozzle changes will be incorporated as a mitigation measure to minimize the potential for adverse effects.

Marine life present at the seafloor depth (about 800 meters) of the proposed experiment consists of sediment assemblages of microbes, macro- and mega-fauna, and meiofauna. Sediment dwelling organisms typically consist of marine worms (polychaetes); starfish and sea urchins (echinoderms); shrimp, crab, and lobster (crustaceans); and bivalves. Sponges, crinoids, deep-sea corals, and other sessile cnidarians can also dwell on hard substrates. Shrimp, snappers, and deep-sea precious corals constitute exploited species that live or feed on the seafloor at about 800-meter depth. Examinations of seafloor videotapes indicate that the habitat and biota at the site off the western coast of the Island of Hawaii are typical of the slopes of the main Hawaiian Islands. Deep-sea benthic species are distributed at similar depths on the slopes of all the main Hawaiian Islands.

The greatest concentrations of zooplankton generally occur within 250 meters of the ocean surface, but below a depth of about 200 meters the plankton biomass in the seawater declines significantly with increasing depth. At the depth of the bulk of the plume of CO₂-affected water (i.e., below about 700 meters), the zooplankton density would be expected to be very low. Organisms in the midwater region from 200-meter to 1,000-meter depth depend on the surface waters for virtually all of their food. Vertebrate density at depths below 200 meters is relatively low, although some surface associated species, including marine mammals, sea turtles, and fishes, may forage at these depths. The most common organisms present in the midwater regions are shrimp, squid, and small fishes.

The most abundant and ubiquitous organisms in the surface waters less than 200-meter depth are plankton. At the site off the western coast of the Island of Hawaii, a variety of pelagic fish species exist in the surface water, including tunas, billfish, swordfish, and dolphin. These species would not be expected to descend to depths greater than 500 meters, which would be above the predicted level of rise of CO₂-enriched water from the release point.

Data on the effects of acidity levels on marine organisms indicate that exposure to seawater with a pH as low as 6.5 for a time duration approaching 24 hours would not result in substantial levels of mortality to marine macrofauna and plankton. However, the potential exists that injury to certain marine organisms would result if exposures to seawater with a pH lower than 6.5 persist for a sufficiently long period of time. During the three-hour period when exposures to pH levels of 6.5 or lower would be possible in a portion of the plume of CO₂-enriched water from each test release, some losses of deep-water plankton and effects on mobile communities would be expected. However, due to the relatively short time duration when acidity levels would be sufficiently high to cause adverse effects and due to the anticipated low density of zooplankton in water at the ocean depths affected by the experiment, no substantial adverse effects would be expected. No adverse effects on surface water marine life would be expected, and only minor stress on midwater plankton populations would be anticipated.

Threatened and endangered reptile and mammal species are not normally found at ocean depths that would experience any changes in water quality as a result of the experiment. For any of these air-breathing species that do descend to such depths, the time duration spent at the depth of affected ocean water would be limited due to the need to return to the surface. In addition, the affected ocean water would exhibit acidity levels that would not be expected to be caustic to body surfaces.

HISTORIC AND CULTURAL RESOURCES:

No impacts on archaeological or historic sites would occur. Consultation with the State of Hawaii's Historic Preservation Division has confirmed that no adverse effects on historic properties listed, or eligible for listing, in the National Register of Historic Places would result from the proposed project off the western coast of the Island of Hawaii. A cultural resource study confirmed the existence of traditional practices associated with fishing and

the significance of ocean currents in guiding both continuation of those practices and exercise of religious beliefs. The proposed project would have no effect on currents at any depth and, aside from the presence of surface vessels for a maximum of two weeks during the proposed experiment, no physical disruption of fishing practices would exist during the experiment. As previously noted, effects on marine species would not be significant.

AIR QUALITY AND CLIMATE:

Vessels used to conduct and support the experiment would produce air emissions from engine operations. These engine exhausts would be typical of emissions generated by ocean vessels and would not be expected to result in any significant effects on air quality.

None of the liquid CO₂ released during the experiment would be expected to escape into the atmosphere. In the event of an accident that would result in a tubing rupture near the ocean surface, rapid release of approximately one ton of CO₂ into the atmosphere would occur. This level of release would produce no significant impact on air quality. Standard precautions for maintaining and monitoring tanks, equipment, and tubing would be used to reduce risks that might result from a slow leak of CO₂.

NOISE AND VIBRATION:

Elevated sound levels would be created from operation of research vessels and experimental equipment. These sounds would not be audible on land. The sound levels would be comparable to those typically produced from other ocean vessels. These temporary and intermittent low sound levels would not be expected to adversely affect marine species.

TRANSPORTATION:

Surface vessels would follow provisions contained in the "International Regulations for Prevention of Collisions at Sea" and provide an informative notice to local boating community regarding the test area and duration of operation. Small increases in vessel traffic would occur for short periods during the 2-week experiment. The presence of needed surface vessels would temporarily limit movements of other surface vessels in the vicinity of experimental activity. The normal activities of fishing boats, other vessels, and recreational ocean pursuits would not be significantly affected.

LAND USE:

Except for the use of existing and available land resources to provide logistical support for the experiment, no new requirements for land use would be expected.

AESTHETICS:

No alteration of the existing seascape or other visual amenities would result from the experiment.

SOCIOECONOMICS:

The experiment would result in purchases of currently marketed goods and services from local and nearby communities. No adverse socioeconomic effects would be expected.

PUBLIC FACILITIES AND SERVICES:

No new public services would be required for conduct of the experiment, and no measurable strain on existing facilities and services would be anticipated.

PUBLIC SAFETY & HEALTH:

Conduct of the experiment would not result in any significant safety or health consequences to the general public.

BIODIVERSITY AND ENVIRONMENTALLY SENSITIVE RESOURCES:

The subsurface ocean environment below 500 meters does not contain environmentally sensitive resources. No effect on reef-building or precious corals, which are limited to depths far above the

800-meter depth of the experiment would occur. Seafloor surveys indicate that the site off the western coast of the Island of Hawaii does not provide habitat for environmentally sensitive resources.

POLLUTION PREVENTION:

The experiment would use the minimum quantity of CO₂ release necessary to achieve the goals of the project, and both the number and the duration of tests would be limited to the minimum quantities needed to achieve experimental objectives. All equipment would be removed following completion of the experimental testing.

ENVIRONMENTAL JUSTICE:

The proposed action would occur well offshore in ocean waters of moderate depth. No disproportionately high or adverse impact on minority or low-income communities would be expected.

LONG-TERM AND CUMULATIVE IMPACTS:

Within 12 hours following completion of the final test release of CO₂, the affected ocean water would be expected to return to the ambient characteristics that existed before starting the experimental research. Any adverse impacts that would be experienced by

sediment-dwelling marine life on the small area of seafloor that would be affected by equipment placement and movement would likely require months to several years for complete recovery.

ALTERNATIVES CONSIDERED: The alternatives considered in the Final Environmental Assessment consisted of (1) participation with the group of friendly nations and private entities in the conduct of the proposed experiment and (2) a No-Action Alternative, under which DOE would not participate in the experiment. For performing the experiment, vessel-based sites were considered – a site off the western coast of the Island of Hawaii and a Generic Ocean Site, each of which would need to possess the following set of qualifying characteristics for conduct of the proposed experiment:

- Water depth of approximately 800 meters (2,600 feet);
- Weather and wave regime that would allow research vessels to maintain position and not cause undue delays;
- Proximity to (and availability of) land-based support facilities needed for research vessels and associated scientists; and
- Absence of particularly sensitive natural resources in the potentially affected areas.

Examples of candidate sites for the research experiment were identified in Section 4.2.2.2 (Vessel-Based Concept) of the EA – these included sites offshore from the Hawaiian Islands, an offshore Norwegian location, and sites in the Gulf of Mexico offshore from Texas or Louisiana. A site approximately 1.9 kilometers off Keahole Point, on the western coast of the Island of Hawaii, was identified in the EA as the best candidate site for the experiment; the characteristics of this site were used as the environmental baseline of existing marine conditions for consequence analysis.

However, conduct of the proposed experiment offshore from the Hawaiian Islands at a Generic Ocean Site possessing the requisite characteristics identified above was also considered in the EA. The potential consequences of conducting the experiment at such an alternative site would be similar to the potential consequences identified in the EA if the Generic Ocean Site possessed a seafloor and marine environment similar to that described in the EA for the Keahole Point site.

MAJOR ENVIRONMENTAL CONCERNS AND MITIGATION MEASURES:

DOE has determined that the proposed action, for participation through the international agreement in a research experiment for examining the dispersion and dissolution of liquid CO₂ in ocean waters of moderate depth, as defined in the Final Environmental Assessment, is not an action significantly affecting the quality of the human environment. This determination is based on the following: the lack of any significant adverse impacts that would occur as a result of the proposed action, as documented in the EA; the short duration of the experiment; the fact that each test release of CO₂ would be limited to a maximum duration of two-hours, during which affects would be examined; and the

existence of a contingency plan for modification, suspension, or termination of experimental activities should unanticipated adverse effects be identified.

DOE considers, however, that additional measures or precautions would be appropriate to further reduce perceived uncertainties and public concerns about the proposed research experiment. Therefore, DOE commits to participate in the proposed experiment based on agreement by the consortium of international participants involved in the experiment that the following additional mitigation measures will be incorporated into planning and conduct of the proposed experiment:

(DOE) Mitigation Measure # 1. The ocean site for the experiment shall be relocated away from prime fishing grounds, such as those that exist off Keahole Point, Hawaii. While conduct of the proposed experiment at the Keahole Point site would not be expected to result in any significant impacts, DOE has determined that location of the experiment at a site away from the prime fishing ground off the western coast of Hawaii but within waters possessing comparable characteristics further from the Hawaiian coastline would be environmentally preferable. Candidate locations are:

- approximately 18 nautical miles due north of the Keahole Point, Hawaii, site (12 nautical miles offshore) at 20° 1' 34" N, 156° 5' 6" W
- approximately 8.5 nautical miles offshore from Barbers Point, Oahu at 21° 12' N, 158° 6' W, about 10 nautical miles from the existing ocean dumping sites located south of Pearl Harbor
- approximately 4 nautical miles offshore from Nawiliwili Harbor, Kauai, at 21° 55' N, 159° 17' W

(DOE) Mitigation Measure # 2. The experimental planners shall confirm and document, based on visual observation, measurement, or sound professional judgement based on reliable public evidence, that the site selected for relocation of the proposed experiment possesses both the requisite characteristics for conduct of the proposed experiment and seafloor and marine life characteristics comparable to, but not more environmentally sensitive than, those identified in the Final Environmental Assessment.

(DOE) Mitigation Measure # 3. The experimental planners shall identify a group of non-project affiliated individuals possessing knowledge of the scientific and technical principles and expertise on the ocean environment and marine life that are relevant to the planning and implementation of the experiment. This group shall provide advice and counsel regarding the experiment and shall be provided an opportunity to observe experimental activities.

(DOE) Mitigation Measure # 4. During conduct of experimental activities, the chief biologist shall be assigned as the final authority for decision-making regarding potential significance of observed effects on marine life and shall possess authority to modify (including the possibility of suspension or termination of a release of CO₂) the experimental protocol after notification and discussion with the chief scientist. If a release is suspended or terminated, the chief biologist, after consultation with the chief

scientist, the advisory group, and others, shall determine the schedule, conditions, and parameters for resumption of experimental activities.

(DOE) Mitigation Measure # 5. Except for required and essential maintenance, the experimental planners shall limit the total number of deployments of the release platform and tubing to a maximum of two – one deployment each for testing one of two different nozzle configurations.

In addition to the specified mitigation measures, the experimental planners shall implement relevant recommendations identified during DOE's consultation processes. These recommendations, which have been incorporated as mitigation measures for the experiment, consist of the following:

Recommendation # 1. Suspend or delay any release of CO₂ if aggregations of marine mammals or protected species are observed within a project corridor that might be affected by the experiment. Define that safety zone and search area and prescribe the methods and approach to be used for marine mammal searches. Submit the plan to the National Marine Fisheries Service (NMFS) at least 30 days prior to initiation of the experiment.

Recommendation # 2. Prepare and submit, to the NMFS and the U.S. Coast Guard at least 30 days prior to the initiation of experimental activities, a response plan for accidental releases of CO₂ and any other hazardous materials to be used during the experiment.

Recommendation # 3. Disseminate to the NMFS, other potentially interested parties, and the public, as soon as possible following completion of experimental testing, information from observations of marine mammals and protected species and from monitoring and measurement of the effects of CO₂ on the ocean environment.

Recommendation # 4. Monitor the behavior of the plume of seawater having a reduced pH if any substantial plume characteristics that were not predicted by the preliminary modeling should be identified.

Recommendation # 5. Monitor acute effects on animals near the CO₂ release point during the course of the experiment.

Recommendation # 6. Include in the experimental protocol provisions to modify the release (with respect to rate, timing, current, speed, or other factors), based on exceedences of threshold environmental conditions or anticipated monitoring results. Specify the ranges of conditions planned for environmental monitoring and the types of contingency actions that would be implemented if threshold conditions should be exceeded.

Recommendation # 7. Include in the experimental protocol provisions for video monitoring of the seafloor imprint created by the release platform and CO₂ transport tubing.

Recommendation # 8. Immediately suspend CO₂ release and communicate to the NMFS and the U.S. Fish & Wildlife Service if any adverse impacts to threatened or endangered species are observed and initiate consultation as appropriate.

FINDING: Based on the information and data contained in the Final EA, DOE finds that no significant impact would result from implementing the proposed Federal action, to participate in conduct of an approximately two-week duration experiment for testing the dispersion and dissolution of carbon dioxide in ocean waters of moderate depth. DOE also finds that implementation of the identified mitigation measures will further address public concerns and perceived uncertainties regarding the experiment and further ensure that adverse consequences would not occur. Therefore, consistent with Title 10 CFR, Part 1021.322, DOE has incorporated the identified mitigation measures into a Mitigation Action Plan for participation in the experiment.

This Finding of No Significant Impact is made pursuant to the National Environmental Policy Act (NEPA) of 1969 [42 U.S. Code 4321 *et seq.*]; the Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of NEPA, Title 40 CFR, Part 1500-1508; and the DOE's NEPA Implementing Procedures, Title 10 CFR, Part 1021. The Proposed action does not constitute a major Federal action that would significantly affect the quality of the human environment within the meaning of the National Environmental Policy Act. Therefore, an Environmental Impact Statement is not required and DOE is issuing this FONSI.

ISSUED IN PITTSBURGH, PA, THIS 02 DAY OF MAY 2001

Rita A. Bajura
Director
National Energy Technology Laboratory

Appendix M: Article Database

Database of documents and articles about the Hawaii CO₂ Ocean Field Experiment

Project Documents

Title	Site Selection Study for an Ocean CO ₂ Disposal Field Experiment
Author	Eric Adams and Howard Herzog
Publication	Prepared for Research Institute for Innovative Technology for the Earth
Date	February 1998

Title	Environmental Assessment: Ocean Sequestration of CO ₂ Field Experiment
Author	U.S. Department of Energy, National Energy Technology Laboratory
Publication	DOE/EA-1336
Date	March 2001

Articles about Project

Title	Feds to Test Impact of Dumping CO ₂ into Kona Waters
Author	Bobby Command
Publication	West Hawaii Today
Date	March 18, 1999
Page	1A, 4A

Title	Experiment to Inject Carbon Into Ocean to Take Place in Kona
Author	Pat Tummons
Publication	Environment Hawaii
Date	August 1999
Page	6-7

Title	Ocean Sequestration Information Meeting Slated
Author	Bobby Command
Publication	West Hawaii Today
Date	October 6, 1999
Page	4A

Title	CO ₂ Test Is Bad for our Ocean
Author	Tina Owens
Publication	West Hawaii Today
Date	November 3, 1999
Page	11A

Title	CO ₂ Project Criticism Rebutted by UH Project Researcher
Author	Stephen M. Masutani, Ph.D., P.E.
Publication	West Hawaii Today
Date	November 9, 1999
Page	11A

Title	CO ₂ Dumping Is Not the Answer
Author	Doug Perrine
Publication	West Hawaii Today
Date	November 18, 1999
Page	11A

Title	Bury Carbon Dioxide to Fight Global Warming?
Author	Associated Press
Publication	Hawaii Tribune-Herald
Date	May 1, 2000
Page	1, 10

Title	Isle Ocean Test Aims to Combat Global Warming
Author	Rod Thompson
Publication	Honolulu Star-Bulletin
Date	August 10, 2000
Page	A-5

Title	Carbon Dioxide Experiment Proposed off Keahole Point
Author	Bobby Command
Publication	West Hawaii Today
Date	August 10, 2000
Page	1A, 4A

Title	Kona Coast Chosen as Site for 'Greenhouse' Gas Experiment
Author	Jason Armstrong
Publication	Hawaii Tribune-Herald
Date	August 17, 2000
Page	1, 6

Title	Big Isle Test May Shed Light on Global Warming
Author	Jen TenBruggencate
Publication	The Honolulu Advertiser
Date	September 5, 2000
Page	B1

Title	Fisherman Opposes Gassing of Isles' Waters
Author	Jan TenBruggencate
Publication	The Honolulu Advertiser
Date	September 12, 2000
Page	

Title	Dumping Off Kona Planned
Author	Jim Rizzuto
Publication	West Hawaii Today
Date	September 25, 2000
Page	10A, 12A

Title	When Is a Bluefin Not One?
Author	Jim Rizzuto
Publication	West Hawaii Today
Date	October 9, 2000
Page	12A-13A

Title	Study: Iron Dumped in Ocean Increases Greenhouse Gas-Eating Algae
Author	Matthew Fordahl
Publication	West Hawaii Today
Date	October 12, 2000
Page	2A

Title	Retired Professor: Experiments Off Keahole a Cause for Concern
Author	Bobby Command
Publication	West Hawaii Today
Date	October 17, 2000
Page	1A

Title	State Ono Record Bested by 8 Pounds
Author	Jim Rizzuto
Publication	West Hawaii Today
Date	December 11, 2000
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