OIL SPILL RESPONSE TECHNOLOGY

HEARING

BEFORE THE

SUBCOMMITTEE ON OCEANOGRAPHY, GREAT LAKES AND THE OUTER CONTINENTAL SHELF

AND THE

SUBCOMMITTEE ON COAST GUARD AND NAVIGATION

OF THE

COMMITTEE ON MERCHANT MARINE AND FISHERIES HOUSE OF REPRESENTATIVES

ONE HUNDRED SECOND CONGRESS

FIRST SESSION

ON

EXAMINATION OF THE STATUS OF STATE-OF-THE-ART TECHNOLOGIES FOR RESPONDING TO OIL POLLUTION EMERGENCIES

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CONTENTS

OIL SPILL RESPONSE TECHNOLOGY

TUESDAY, JUNE 18, 1991

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON OCEANOGRAPHY, GREAT LAKES AND THE OUTER CONTINENTAL SHELF, AND THE SUBCOMMITTEE ON COAST GUARD AND NAVIGATION, COMMITTEE ON MERCHANT MARINE AND FISHERIES,

Washington, DC.

The subcommittees met, pursuant to call, at 2:15 p.m., in Room 1334, Longworth House Office Building, Hon. Dennis M. Hertel (Chairman of the Subcommittee on Oceanography, Great Lakes and the Outer Continental Shelf) presiding.

Members present: Representatives Hughes, Hertel, Carper, Pickett, Hochbrueckner, Pallone, Lowey, Taylor, Abercrombie, Reed, Young, Fields, Bateman, Coble, Weldon, Herger, Inhofe, Goss, Callahan, and Gilchrest.

Staff present: Elizabeth Megginson, Counsel/Staff Director, Coast Guard Subcommittee; Deborah Dawson, Counsel, Oceanography Subcommittee; Lee Crockett, Professional Staff; Lori Williams, Counsel; Jim McCallum, Professional Staff; Donna Napiewocki, Professional Staff/Clerk, Oceanography Subcommittee; Mike Quigley, NOAA Fellow; Terry Schaff, Sea Grant Fellow; Mimi Simoneaux, Clerk, Coast Guard Subcommittee; George Pence, Minority Staff Director/Counsel; Mark Ruge, Minority Deputy Staff Director/Counsel; Sherry Steele, Minority Counsel; Rod Moore, Minority Professional Staff; Dave Whaley, Minority Professional Staff; Hoyt Wheeland, Minority Professional Staff; Harry Burroughs, Minority Professional Staff; and Margherita Woods, Minority Chief Clerk.

OPENING STATEMENT OF HON. DENNIS M. HERTEL, A U.S. REPRESENTATIVE FROM MICHIGAN, AND CHAIRMAN, SUBCOMMITTEE ON OCEANOGRAPHY, GREAT LAKES AND THE OUTER CONTINENTAL SHELF

Mr. HERTEL. The Subcommittee on Oceanography, Great Lakes, and the Outer Continental Shelf joins the Subcommittee on Coast Guard and Navigation in examining the status of state-of-the-art technologies for responding to oil pollution emergencies. Our panelists comprise the various Federal agencies whose mission it is to engage in activities to control, contain, remove, and restore precious habitat suffering the after-shocks of oil spills.

Legislation adopted by the Merchant Marine and Fisheries Committee last year establishes a massive trust fund for cleanup work, imposes a serious liability on oil transporters for spills, and supports research and development coordination projects to mitigate

environmental damage. We hope that our witnesses will testify as to their respective roles in implementing the Oil Pollution Act.

The magnitude of the *Exxon Valdez* accident serves as a painful reminder that too many inadequacies have been tolerated. As a result, havoc has been wreaked on precious wildlife time and time again. The inadequacies extend from the ready competence of tanker pilots to the structural deficiencies of American vessels chartered to haul frequent massive amounts of crude. The inadequacies raise questions about unabated fuel consumption and reliable means for reducing the risk of more pollution. Most startling of all, once faced with a crisis, we lack the ability to restore the environment in a manner that does not cause further multiple brutal attacks on animal, plant, and marine life already crippled by oil.

It horrifies me to think that "steam cleaning" was the best our technology had to offer for Prince William Sound, that we didn't experiment with it first. Subjecting intertidal creatures to thermal shock and leaving a beach "pretty to the eye" yet with its ecological balance so traumatized, so that it may never fully recover, is a real tragedy. I wonder what I will be told today that is reassuring.

I do not want to return to Valdez or anywhere in the world like it. Seeing a landscape overcome by oil and slick, without any effective means for salvaging the varied life forms and their habitats is an inadequacy we can't afford. I tell the Members of the committee that, obviously, that was the worst disaster of any oil spill that we have seen in the past, and the damage is incalculable. It was, as I have said, an accident waiting to happen. And what we have to learn from it is how to prevent it, obviously; and if it does happen, how to respond more quickly; and in the event of a cleanup, what actually works and doesn't make the situation worse. That is the job on the two subcommittees meeting here today. We have that responsibility, and that is why we are happy to have the people here to give us the advice and the facts in this very, very important area. I call on Mr. Bateman for an opening statement.

STATEMENT OF HON. HERBERT H. BATEMAN, A U.S. REPRESENTATIVE FROM VIRGINIA

Mr. BATEMAN. Mr. Chairman, I don't know that any opening statement is necessary for me. I think you have certainly set the context in which we are conducting this hearing. We have, I believe, the right witnesses before us to acquire valuable information. If anything, I would just want to echo your view that anything we can do to enhance the prevention of the kind of oil spill that we encountered with the *Exxon Valdez*, ought to be at the head of everybody's agenda, recognizing the fact that even the best prevention may nonetheless leave us with problems. We certainly need to have a firm grasp on the technology by which we deal with oil spill problems, and I look forward to the testimony of the witnesses.

Mr. HERTEL. Thank you. Other opening statements? Mr. Abercrombie.

STATEMENT OF HON. NEIL ABERCROMBIE, A U.S. REPRESENTATIVE FROM HAWAII

Mr. ABERCROMBIE. Mr. Chairman, thank you for letting me join you today in this joint hearing of the House Subcommittee on Oceanography, Great Lakes and the Outer Continental Shelf and the Subcommittee on Coast Guard and Navigation.

The issue of oil spill cleanup and restoration measures is of extreme concern to us in Hawaii. The infamous March 23, 1989, *Exxon Valdez* oil spill in Prince William Sound, Alaska, inflicted billions of dollars worth of damage and made Americans across the Nation stand up and take note of an area that desperately needs to be addressed—that of oil spill cleanup.

As an island State, Hawaii is constantly reminded of its vulnerability to aquatic pollution. As you may know, Mr. Chairman, others in the room may not, the *Exxon Valdez* was on its way to Oahu from Alaska as, apparently, we are going to be on our way very shortly. So hopefully between now and the time we vote, there will not be a spill off the coast of Hawaii. Again, for the information of the committee, it is not unusual for tankers of 100,000 tons with capacities of 25 million gallons to ply Hawaiian waters. These tankers have to battle two very fierce obstacles, and I know the two captains here from the Coast Guard will verify this, the coral reefs surrounding the Hawaiian Islands—we just had a tugboat right off of Diamond Head crash into the reefs there—and the *Ill Wind* of Hawaii, the *Kona Wind,* and these buffet ships. We are not prepared to deal with these oil spills right now, and it has only been because we have had luck on our side. So these hearings are very, very important to us, Mr. Chairman, and I appreciate the opportunity to be here.

And, parenthetically, can I just thank Captain Holt and Captain Jensen for being here and say to them publicly and for the record that you have two excellent people in Hawaii in Captain Curt Martin and Lieutenant Eric Mosha who have been more than just helpful but excellent officers who are doing a fabulous job and have made sure that our people out in Hawaii are as well-informed as they possibly can be on what we need to do.

Mr. HERTEL. Mr. Young.

STATEMENT OF HON. DON YOUNG, A U.S. REPRESENTATIVE FROM ALASKA

Mr. YOUNG. I know I look forward to hearing the witnesses. Before we go on though, you mentioned in your opening statement, Mr. Chairman, about what happened in Alaska. I just hope many of us recognize that that was a tragedy. I have never looked upon it as a total disaster. I think in retrospect it has probably given us a great deal of information we didn't have before.

But more than that, talking about steam cleaning the beaches, very honestly, that was primarily the result of hysteria and not logically looking at the impact. We had people—I believe many of our scientists said this was the wrong thing to do, but the demand by the public and the interests of the media, "Oh, you have got to keep it squeaky clean." And I think that also has to be taken into consideration. Technology does little good if you follow hysteria re-

actions. You have to let the scientists actually help us direct this and make sure we do the correct thing instead of responding to NBC and Dan Rather. And that one dead duck I saw 450 times in three weeks.

Mr. HERTEL. Well, there is no hysteria here at this meeting. Mr. Reed.

STATEMENT OF HON. JOHN F. REED, A U.S. REPRESENTATIVE FROM RHODE ISLAND

Mr. REED. Thank you, Mr. Chairman, for allowing me to participate in this hearing today. The issue of oil spills and responses are very important to the State of Rhode Island. In 1989, the Greek tanker, *World Prodigy*, ran aground and spilled a considerable amount of oil into Narragansett Bay. Except for the fortunate happenstance that it was refined oil, that it was a warm summer day, and the fact that in the days that followed we had a rapid response by the Coast Guard and thousands of Rhode Islanders, we could have had a tragedy that paralleled that of the Valdez incident in Alaska.

And so it is important, I think, to recognize that spills do happen. And unless we are properly prepared, not only with technology but also with a prepared oil spill response infrastructure composed of the Coast Guard and State plans, we will see additional damage to the environment from which we cannot recover. And so I thank the gentlemen today for their testimony and look forward to what they will let us know about the terribly important issues of oil spill technology and control. Thank you, Mr. Chairman.

Mr. HERTEL. Are there other opening statements? Well, before we break for the vote then, I will introduce the panel that was here on time and have been so patient.

Mr. HUGHES. Mr. Chairman?

Mr. HERTEL. Mr. Hughes.

Mr. HUGHES. I have a statement I would like to put in the record, Mr. Chairman, and I'd like to say that I am looking forward to a report on the state of the technology. Unfortunately, during the Coast Guard's lean years, one of the first areas we cut was R&D. We have paid some penalty for that, so I look forward to seeing where we are today and where we need to go. Thank you, Mr. Chairman.

Mr. HERTEL. Thank you. I will include your statement for the record.

[The statement of Mr. Hughes follows:]

STATEMENT OF HON. WILLIAM J. HUGHES, A U.S. REPRESENTATIVE FROM NEW JERSEY

I would like to thank my colleagues, Congressman Hertel and Congressman Tauzin for holding this joint hearing today. I am very interested in the current state of technology in oil spill cleanup and response measures and look forward to the witnesses testimony today.

Within the last few years, we have witnessed oil spills in the Gulf of Mexico; off the coasts of Washington and Hawaii; in the Savannah River, Georgia; in Ohio's Monongahela River; in the Arthur Kill shipping channel between New York and New Jersey; the massive *Exxon Valdez* in Alaska; and, most recently, the oil disaster in the Persian Gulf.

In all of these instances, the oil spills have resulted in damage to the ecosystem, waterfowl, wildlife, and fishery resources. In Alaska, some quarter of a million bar-

oils poured out of the *Exxon Valdez* into Prince William Sound. As obvious as the environmental damage, were the shortcomings of the cleanup and response—including the initial delay in responding to the spill during the first critical hours, the overall communication problems, the difficulties with assembling an emergency team, the lack of barges and equipment to contain the spill, and the problems with the chemical dispersants. In addition, a recent National Oceanic and Atmospheric Administration report indicated that the hot water technology used to clean oiled beaches proved far more damaging than leaving the beaches alone.

Last year, we again witnessed the inadequacy of oil spill cleanup technology and response during an oil spill on the Delaware River. Because funding for research and development was severely cut, the Coast Guard lacked the capability to effectively clean up after that spill. Vessels in the Delaware River were using pitch forks and fishing nets. That's a far cry from state-of-the-art technology.

For the past 15 years, I have worked, along with my colleagues from the Merchant Marine and Fisheries Committee, on developing a national framework to protect our inland waterways and coastal resources from oil spills, and provide compensation to those injured by a spill. Last Congress, I served on the conference committee in the final phase of formulating a national policy on oil spill liability, compensation, prevention, and response.

The end result, the Oil Pollution Act of 1990, established a one billion dollar fund, financed by oil industry, through a five cents per barrel tax on oil, for the immediate cleanup of spills, and compensation for those who suffer damages from the spill. The fund is also available to the Coast Guard to purchase equipment and increase manpower, allowing them to effectively respond to spills in a timely manner.

It is clear from the rash of damaging accidents which have occurred around the country in the past two years, that our ability and resources had been too limited to adequately respond to oil spills. I am curious to know how the Coast Guard has implemented the mandates of the Oil Pollution Act and the state of our knowledge in effectively responding to oil spills. Has this act emphasized improved prevention, quicker response, and promoted the development of better technology to clean up spills as it was designed to do? How far have we progressed since the *Exxon Valdez* disaster? Are we prepared to effectively respond to an oil spill much larger than the size of the *Exxon Valdez* if it were to happen today?

Even with the best technologies and methodologies for response and remediation—under the best circumstances—efforts aimed at a timely response may be hindered; practical limitations may get in the way, and surely, we will be faced with another catastrophic oil spill; perhaps as terrible as that which occurred in Prince William Sound, or as frequent as those which have ravaged the Arthur Kill last spring and summer.

As policymakers, we are responsible for ensuring that contingency cleanup plans work. We need a firm commitment from the oil industry and the Coast Guard that they will be better prepared in the future with adequate spill containment, cleanup equipment, and a trained crew ready to respond immediately.

I welcome the witnesses today and eagerly look forward to their views on the present state of oil spill cleanup technology. Thank you, Mr. Chairman.

STATEMENT OF HON. BILLY TAUZIN, A U.S. REPRESENTATIVE FROM LOUISIANA, AND CHAIRMAN, SUBCOMMITTEE ON COAST GUARD AND NAVIGATION

I would like to thank my colleague, Chairman Dennis Hertel for joining with me in calling this hearing on the current state of oil spill response planning and techniques. The continuing problems associated with the tragic spill of oil in Prince William Sound, Alaska have taught us that there is no substitute for advanced planning, research, and development in the area of oil spill prevention, response, and restoration. The results of the study conducted in Prince William Sound on the effects of the hot water washing of beaches indicate that such drastic action may have done more harm than good.

We need to insure the actions taken are those that will be most protective of the long-term environment. There are those who call for immediate, short-term results and who are impatient when it is suggested that a longer-term remedy might be called for. This study suggests that nature may under certain circumstances, have a slower, yet better way of dealing with even catastrophic spills—particularly when nature gets a little help from man.

The Oil Pollution Act of 1990 provides for a national research, development, and demonstration program. With so many agencies involved, Congress found a need for coordination of all Federally-funded or sponsored research programs. It is anticipat-

ed that an interagency committee will be established not only to coordinate agency actions, but to plan and evaluate research efforts which hopefully will produce new techniques and technologies for oil pollution prevention and response.

In addition, the Oil Pollution Act anticipates that response agencies will provide pre-clearance and pre-approval for oil spill response technologies so that in the event of an emergency, these technologies can be used promptly, without confusion or concern for safety or effectiveness.

Today, we will hear from the primary Federal agencies responsible for carrying out the Oil Pollution Act's research and development program. It is important that this program be implemented as quickly as possible, so that the results can be available and usable within the near future. Full funding for research and development must be made available and must be used efficiently. The universities and private sectors must be included in the effort because that is where so much of the innovation is taking place.

I look forward today to the testimony to be presented and to working with you, Mr. Chairman, toward a research and development program that offers the hope of both preventing oil spills and providing for prompt and effective response.

Mr. HERTEL. I will read down the witness list, and then we will come back to Captain Donald S. Jensen, Chief of Applied Science Division, Research and Development Center, United States Coast Guard, accompanied by Captain William F. Holt, Chief of Environmental Protection Division, United States Coast Guard Headquarters; Mr. David Kennedy, Acting Chief, Hazardous Materials Response Branch, NOAA, U.S. Department of Commerce; Mr. Fred Lindsey, Director, Office of Environmental Engineering and Technology Demonstration, Environmental Protection Agency; Mr. Edward Tennyson, Program Manager, Oil Spill Response Division, Minerals Management Service, U.S. Department of the Interior. So we will come back in about 10 minutes and begin with Captain Jensen. Thank you.

[Recess.]

Mr. HERTEL. Sorry about the interruption. Captain Jensen.

STATEMENT OF CAPTAIN DONALD S. JENSEN, CHIEF OF APPLIED SCIENCE DIVISION, RESEARCH AND DEVELOPMENT CENTER, UNITED STATES COAST GUARD; ACCOMPANIED BY CAPTAIN WILLIAM F. HOLT, CHIEF OF MARINE ENVIRONMENTAL PROTECTION DIVISION, UNITED STATES COAST GUARD HEADQUARTERS

STATEMENT OF CAPTAIN DONALD JENSEN

Captain JENSEN. With your permission, I would like to summarize my opening statement. Good afternoon, Mr. Chairman, and distinguished Members of the subcommittees. I am Captain Donald S. Jensen, Chief of the Applied Engineering Division of the Coast Guard Research and Development (R&D) Center in Groton, Connecticut. With me is Captain William F. Holt, Chief of the Marine Environmental Protection Division of Coast Guard Headquarters.

The focus of the discussion today is the current state of technology in oil spill cleanup and restoration measures. From the Coast Guard's perspective, this includes a range of response actions that begin with stabilizing the vessel and offloading remaining cargo, removing the oil from the surface of the water if it escapes from the vessel, and third, monitoring the shoreline cleanup if the oil reaches the shoreline.

Following the *Exxon Valdez* response, the Coast Guard sponsored an ad hoc Federal interagency planning workshop to begin develop-

ment of a coordinated national R&D program to improve oil spill response technology. Perhaps the most significant outcome of that workshop was a coordinated first attempt at identifying technological deficiencies and R&D initiatives for the future. The ad hoc committee formed at this workshop has been formalized by provisions in the Oil Pollution Act of 1990 (OPA-90).

This committee, chaired by the Coast Guard, has worked over the past year to develop a comprehensive five-year R&D plan. Interagency subcommittees have developed the five main sections of the plan: prevention, spill planning and management, spill response, fate and effects, and restoration. The draft plan has been reviewed by the National Academy of Sciences and the State representatives of the regional response teams and is undergoing final agency review. We anticipate that the plan will be submitted to Congress in the near future. Concurrently, the committee is addressing mechanisms to implement the regional grants program and demonstration projects called out in OPA 1990.

The Coast Guard has initiated a comprehensive R&D program that focuses on three areas: prevention, spill planning and management, and spill response. Prevention has been and will remain a Coast Guard priority. It is a large part of our overall program, but is outside the scope of today's hearing.

In the area of spill planning and management, the Coast Guard, in cooperation with NOAA, has developed a prototype decision support system for oil spill response that is currently in the test and evaluation phase.

In the spill response area, several efforts are underway. For improved surveillance, we are working with other U.S. and Canadian agencies, as well as private industry, to provide a critically needed day/night, all-weather oil spill surveillance capability through the development of advanced oil spill sensors.

The Coast Guard has taken the lead role in the area of tanker countermeasures to develop improved methods and equipment to assess the damage to the tanker, to stabilize the vessel, and remove the remaining cargo before it can spill. The state-of-the-art in mechanical recovery and containment is considered primitive by many. However, the well-understood physics of oil behavior in the ocean environment will likely prevent any major breakthroughs in this area. Despite inefficiencies, mechanical containment and recovery remains the preferred method of oil spill response over the wide range of conditions encountered. Some advances can be made in developing better debris handling, oily water separation, temporary storage, and oil disposal techniques to streamline mechanical recovery operations.

Each of the other various techniques for controlling oil pollution have positive and negative points. Dispersants offer the opportunity to facilitate natural processes but at the risk of affecting organisms in the water column. Bioremediation also facilitates the natural processes, but at a speed and efficiency that limit its utility as a first aid response tool. In-situ burning may efficiently remove oil, but it also adds air pollutants.

Various agencies' research in shoreline cleanup is being monitored by the Coast Guard with great interest. We provided partial funding for the recently-completed NOAA study on the effects of

shoreline cleanup in Prince William Sound that is the subject of this hearing. Preliminary results of this study indicate that the mechanical shoreline cleanup methods employed there removed some of the oil but at considerable cost to shoreline ecosystems. The use of bioremediation was more promising and has prompted EPA to undertake a major R&D initiative in this area. We are not suggesting that technological initiatives and successes can guarantee the complete mitigation and cleanup of a catastrophic oil spill.

We don't think that there is a silver bullet out there waiting to be discovered that will solve all of our problems. We need to learn as much as possible about all potential cleanup techniques so that each one can be used to its optimum benefit. We do anticipate that a coordinated interagency and industry R&D program can substantially improve our ability to respond. However, technological progress can be achieved only through a sustained Federal oil spill R&D program.

We feel that the approach being taken by the research and development community is sound, comprehensive, and should be supported in the future. Thank you for this opportunity to speak before the subcommittees, and I will be happy to respond to any questions you have.

Mr. HERTEL. Thank you, Captain.

[The prepared statement of Captain Jensen can be found at the end of the hearing.]

Mr. HERTEL. Mr. Kennedy.

STATEMENT OF DAVID KENNEDY, ACTING CHIEF, HAZARDOUS MATERIALS RESPONSE BRANCH, NOAA, DEPARTMENT OF COMMERCE

Mr. KENNEDY. Thank you. My testimony is already on record, and I don't intend to repeat it here. I will just give you a few summary comments. In fact, a lot of what I was going to say is territory that has already been covered by Mr. Jensen and actually Mr. Young. Some of his comments, I think, are very pertinent to what I consider at the heart of part of this issue.

I will start by talking a little bit about my organization, the Hazardous Materials Response Branch of NOAA, and what we do. We provide technical support information to the Coast Guard in the event of spills. We have a number of categories of types of technical information that we do provide. They include trajectory modeling, resources at risk, analytical chemistry, biological assessment, and data management. We are on 24-hour call to respond to spills. We have Scientific Support Coordinators with support staff located in nine Federal regions around the country. We respond to, approximately, 100 spills a year from our headquarters in Seattle. I have been in the business about the last 15 years, including being prominently involved in our activities at the *Exxon Valdez* oil spill, and I will be happy to answer questions about that in particular later. NOAA also has responsibilities after the initial response emergency phase is over in damage assessment and restoration.

One of the things that I was reminded of that I did not have in my testimony but that I think is pertinent to this committee is a study that was conducted at a conference that was held in Anchor-

age in November of 1989 after the first year's events from the *Exxon Valdez*. The purpose of that conference was to try and determine whether the technology that had been used at the *Exxon Valdez* was, in fact, the best technology available, whether we made the most appropriate use of the technology, and whether there was, as Captain Jensen has referred here, a silver bullet that maybe we missed.

There was a great deal of controversy as to how the cleanup had been conducted and how effective it was. We wanted to make sure that we had left no stone unturned. So we spent a considerable amount of money and time studying what was done at the *Exxon Valdez*. We looked at technology all over the world, trying to see what we had missed, where we had gone wrong, if you could say that we had gone wrong, and what we could have done differently.

The conference was held in November, once we had completed the study, and, unfortunately, the results were that we tried everything that was out there to try; and that probably we tried a great deal more than was currently available when the *Exxon Valdez* went aground and the spill occurred. In terms of a silver bullet, there was none visible on the horizon. There were a few promising technologies that needed to be explored, obviously, but in terms of some prominent technology, there was no prominent system out there that we had not seen or that was in a development phase that we could expect to be on-line anytime in the near future that would really answer our questions and resolve some of the concerns about the lack of appropriate cleanup technology.

Somebody said that they hoped they wouldn't hear bad news. I don't know that we call that bad news, but certainly we have challenges before us to look for new technologies. As has been indicated, there is an awful lot of energy and effort focused right now on trying to do that.

Since part of the meeting here was to discuss NOAA's shoreline study, I thought I would go through just very briefly a few of the results. They are summarized in the invitation letter that I have, and I know you have testimony in front of you that talks about them; but they are significant, and I will just read them very quickly.

Evidence of intertidal recovery was observed at all impacted sites. Chemical analysis of tissues from selected intertidal organisms indicated accumulation of hydrocarbons from the environment but no evidence of magnifications through predatory interactions. Removal of oil through shoreline treatment may have improved conditions for organisms at the sediment water interface and for eelgrass. Flora and fauna at beaches that received light or no shoreline treatment strongly resembled those at unoiled beaches with some reductions in abundance at oil beaches.

Abundances of important intertidal species, such as rockweed, limpets, snails, hermit crabs, and mussels, were significantly lower at beaches that received high-pressure hot water treatment. Distribution and abundance of organisms living in cobble and gravel beaches were reduced to a greater degree by initial intrusive treatment than by hydrocarbon concentrations remaining in beach sediment. Full recovery to pre-spill conditions on rocky shorelines where high-pressure, hot water washing reduced cover of mussel

and vegetation may take 10 years or longer. Long-lived, slow reproducing organisms, such as hard-shell clams, may take many years to recover from the effects of hydraulic burial caused by hot water exposure.

This study is not complete. We have several more years, we feel, where research needs to be conducted to know the whole story; but, obviously, there are some points as I have gone over here that give us pause when we look at the future and how we are going to handle spills.

As I mentioned, Mr. Young's comments actually to some degree parallel some of my own thinking. I am concerned about the amount of public involvement in spill decisions and our lack of defending what, in many cases, probably are going to be unpopular decisions with the public. The drive to try and get the beaches back to their original state when they are oiled in many cases is more damaging than leaving some of the oil there. I am not talking about all of it. I think oil does need to be removed, but I think, certainly, the emphasis for some of us is, and will continue to be, documenting the evidence that supports the need to halt cleanup that has reached the point of diminishing returns in favor of natural cleansing and trying to educate the public so that, in the future, we are not so driven to go so far. Thank you.

Mr. HERTEL. Thank you.

[The prepared statement of Mr. Kennedy can be found at the end of the hearing.]

Mr. HERTEL. Mr. Lindsey.

STATEMENT OF ALFRED LINDSEY, DIRECTOR, OFFICE OF ENVIRONMENTAL ENGINEERING AND TECHNOLOGY DEMONSTRATION, ENVIRONMENTAL PROTECTION AGENCY

Mr. LINDSEY. Good afternoon, Mr. Chairman, and thank you, Mr. Chairman and Members. It is a pleasure to be here today. I am Alfred Lindsey, the Director of the Office of Environmental Engineering and Technology Demonstration at EPA. You have my written testimony; and with your permission, I will just summarize a few of the primary points in the interest of time.

In the wake of the Prince William Sound disaster, EPA, with help from Exxon and the State of Alaska and a panel of outside experts, mounted a concerted effort to demonstrate the ability of bioremediation to hasten the cleansing and recovery of oiled beaches. In 1989 and again in 1990, EPA experimented with the use of several nutrient products to enhance the rate of biodegradation by naturally occurring microorganisms. And within a few weeks, the results were visually apparent. Preliminary testing has confirmed the usual results that the rates of degradation were significantly enhanced.

I brought with me a few small—I guess they are five by seven pictures which I have provided to you. You may want to pass those around. It shows the results visually. I also have a large-scale version of this picture. You may be able to see that from there. You see the window pane effect. This happens to be one of the test beaches that we used nutrient products, and you can see the rela-

tively clean square area in the middle surrounded by an area which was not treated.

We also experienced enhanced degradation in the subsurface as well. And there were no apparent adverse environmental effects from the use of these nutrient products. The data and conclusions from this work will undergo a final peer review by EPA's Science Advisory Board within the next few weeks. But based on EPA's experimental success with this application, Exxon treated some 75 miles of beach with this method with similar visual and scientific results. There remains a lot to learn to optimize the process and to determine how and to what degree it will work in settings other than cobble beaches which is what we tested in Alaska.

But we are convinced that bioremediation is now or will soon be a practical tool for use in responding to many oil spills. It is not, however, a silver bullet. There will be a lot of circumstances where it will not be the optimum way to proceed, and one of those is, for example, in dealing with large concentrations of heavy deposits.

To bring this technology to off-the-shelf status as quickly as possible, EPA is continuing to sponsor a number of activities. Just last Friday, Administrator Reilly met with 100 members of the Bioremediation Action Committee, which we call the BAC, to discuss progress in developing bioremediation as an environmental tool. In conjunction with the BAC, EPA developed interim guidance for preparing bioremediation spill response plans. And in a joint follow-up effort of the Bioremediation Action Committee, the State of Texas and the Region VI Response Team are developing a specific pilot response plan which will focus on Galveston Bay.

Additionally, the BAC, the National Environmental Technology Application Corporation known as NETAC, and EPA scientists have developed a series of standardized protocols for comparing the efficacy and the toxicity of bioremediation products. These test protocols now exist for cobble beaches and for open water and will soon exist for a number of other environmental settings.

Along with other Federal agencies, the EPA has been participating in the development of the interagency oil spill R&D plan which is headed by the Coast Guard. And in addition to bioremediation, EPA will focus its resources and talents on the efficacy and toxicity surrounding the use of dispersants, on containment and removal techniques for inland spills particularly focusing on fast moving and shallow-turbulent streams which pose a real cleanup problem. Since EPA heads cleanup efforts on inland spills, this is an area that we are particularly interested in. Third, we will be looking at the adequacy and cost-effectiveness of alternative management techniques for dealing with collected oil and cleanup debris.

In conclusion, I would like to say that the development of the interagency R&D plan has, I think, brought the Federal community involved with oil spills closer together. I think in a very real sense the agencies have been able to specialize in a few areas where we can make an impact while leaving other R&D efforts to others. And in other areas, cooperative activities are emerging that allow the talents of the several agencies to be brought together in an optimal way.

I think that this cooperative spirit is going to allow us to develop the tools that are necessary to minimize the risk of future spills

and to provide improved cleanup technologies in the event of another major spill. Thank you again for the opportunity to speak before the subcommittees, and I will be glad to try to respond to any questions that you may have.

Mr. HERTEL. Thank you.

[The prepared statement of Mr. Lindsey can be found at the end of the hearing.]

Mr. HERTEL. Mr. Tennyson.

STATEMENT OF EDWARD TENNYSON, PROGRAM MANAGER FOR OIL SPILL RESPONSE, MINERALS MANAGEMENT SERVICE, DEPARTMENT OF THE INTERIOR

Mr. TENNYSON. Thank you, Mr. Chairman. I appreciate the opportunity to testify on the current state-of-the-art for oil spill response in the open ocean and the technology assessment and research program on oil spill cleanup being conducted by the Minerals Management Service of the United States Department of the Interior.

You already have, I believe, the written testimony for the record, and it is much too voluminous to go into in any detail. I would like, with your permission, to offer two more documents for the record. One is a current update, a little more detail in terms of our ongoing program, and the second is our anticipated program plan for fiscal years 1992 through 1996.

The MMS has been involved in continuous research activities on oil spill response since 1979. It has been involved, as you know, in additional activities in terms of prevention. These activities include permitting and regulating of offshore oil and gas operations, reviewing and approving industry exploration, development and production plans, oil spill contingency plans, conducting OCS facility accident investigations, conducting inspections and taking enforcement actions on either a scheduled period or on unannounced situations, and we have been involved very heavily in developing a training program for oil control. That is the prevention aspect, and, obviously, today the primary interest may well be the spill response activities themselves.

MMS has been involved in that for approximately the last 14 years. Our current budget, with cooperative funding, is about $4.8 million a year. My testimony goes through some of the accomplishments we have had to date. It also goes into some detail on what we think the state-of-the-art is, and this is based on a continuing review of accidents, of spills both in the U.S. and worldwide, and the actions we have taken to address those deficiencies.

I would also like to add a line of support to what has been said by my colleagues here at the table, that the opportunity now under the Oil Pollution Act of 1990 for a concerted, coordinated effort for research to improve the situation is something which we have looked for for a long time.

MMS has been involved in a development of two engineering technologies for remote sensing activities. One particular technology will, we believe, give us the opportunity, day or night but not all-weather, to determine whether or not what we are seeing on the surface of the water is, in fact, oil, whether it is biogenic or

naturally occurring fish oil or whether it is petrogenetic, i.e., spilled hydrocarbons, and whether lighter ends or plater ends are present. This capability, we believe, will allow us for the first time to determine remotely whether or not oil exists on the shoreline or in broken ice.

The second major sensing system uses lasers to determine the thickness of the oil. We believe that after a spill has occurred, very quickly the oil spreads into dissimilar thicknesses. There is an old axiom that says, "90 percent of the oil is in 10 percent of the slick, 10 percent of the oil is in 90 percent of the slick." And if you can, by reasonable remote sensing, direct the recovery effort to the thicker portions of the slick, you may be able to increase the recovery rates by hundreds or thousands of times for the given equipment on-scene.

Those particular pieces of equipment should be flown in an engineering prototype phase by the end of this year. Hopefully, we will be able to use them on actual spills, either intentional spills or spills by accident, by the latter part of 1992. We know that the conventional wisdom in the past indicates that most containment capabilities, that is using containment booms in the open ocean, have not been documented in waves of over two to three feet. They may exist but that has not been proven. Conventional equipment tends to lose the oil rapidly when the tow speeds or the currents associated with a recovery operation exceed half to three-quarters of a knot.

We have had the opportunity on an actual spill in Canada to turn around and go with the wind and with the waves, which is 180 degrees away from the way the job normally is done. We were able to contain the oil in three-and-a-half-knot currents or relative velocity of the water and in winds up to 35 knots in associated sea states. So we feel that there are some significant gains perhaps in mechanical containment and recovery if, in fact, you go with the waves and with the wind rather than against it.

We are also looking for additional innovative technologies both for containment in the open ocean and for recovery that are different, new skimmers specifically for high current areas and for areas where there is significant ice cover.

One of our major efforts has been to develop chemical treating agents. We have done over 15,000 chemical treating agent runs evaluating various chemical agents with various kinds of oil in terms of their efficiencies.

A major effort we have become involved in beginning in 1983 was in-situ burning where, in a large range of conditions, we have been able to remove 50 to 90 percent of the oil by burning the oil in place. We have just finished a series of tests down at the Coast Guard base in Mobile, Alabama, where preliminary analysis of the airborne pollutants indicates that, contrary to popular belief, we are not creating additional dioxins, furans, PAH's, or PNAH's which have been items of major concern in the past. We have also looked at the behavior of oils, particularly non-typical oils, because the oil, when you get out to sea to respond to it very quickly, no longer has the same characteristics as it did when it was spilled.

In conclusion, I would like to say that in administering the Nation's offshore program, MMS is committed to managing the re-

sources in an environmentally-sensitive manner. So to that end we are also committed to minimizing any potential adverse environmental impact from the offshore oil-related activities. Therefore, we will continue to place a high priority on oil spill research and are pleased at the additional funding that has been made available through the Oil Pollution Act. That concludes my prepared statement. I would be happy to respond to any questions that you and the Members may have, sir.

Mr. HERTEL. Thanks, Mr. Tennyson.

[The prepared statement of Mr. Tennyson can be found at the end of the hearing.]

Mr. HERTEL. All of you have been very direct and very helpful and answered many of the questions already that the staff has prepared. Captain Jensen, given the improvements in coordination, cleanup, and restoration, and what we have learned since the spill of the *Exxon Valdez*. If there were a similar spill of that size tomorrow, we all hope it would never happen, what do you think would be the difference as far as response time, as far as the assessment of damage because of what we have already learned and what we would be prepared to do?

Captain JENSEN. I think as a result of *Exxon Valdez*, all of our local captain-of-the-port offices are a lot more tuned to dealing with a major response. They have looked over their contingency plans. They have upgraded them for response to a major spill, and I think from that standpoint they certainly are going to be more prepared to respond in a much quicker fashion.

There are still equipment shortfalls out there. They have been identified. We probably would continue to have problems getting enough equipment on-scene. We have learned a lot from *Exxon Valdez* as far as methodologies for assessing shoreline damage and cleanup technology. From that standpoint, we would be a lot more efficient, I think, in that area.

Mr. HERTEL. The GAO issued a report in March estimating that 20 percent of the *Exxon Valdez* costs are unrecoverable. Can you comment on those findings and tell us how we can avoid those problems associated with tracking those costs in the future? How can we do a better job of making sure that the costs are all covered in the future if you agree with the GAO estimate?

Captain JENSEN. I will get Captain Holt to address that.

Mr. HERTEL. Captain.

Captain HOLT. Thank you. We don't entirely agree with all of the findings of the General Accounting Office. We have evaluated their report, and there are some contentious points in their findings. We have, however, since the enactment of the Oil Pollution Act, established within Coast Guard Headquarters, a National Pollution Funds Center to manage the new Oil Spill Liability Trust Fund. And they will be setting up a tracking system for accounting of costs expended by Federal agencies during a response.

Mr. HERTEL. Thank you. Mr. Kennedy, during the damage assessment phase of oil spill cleanup, you collect data to use (1) in planning for the cleanup and restoration and (2) in assessing overall damage for subsequent litigation. We understand the problem of being able to reveal the damage assessment that could be used against us in litigation. On the other hand, there is the problem of

us having the knowledge, our government having the knowledge. We have discussed this before at a hearing. What would you recommend we can do, if anything, to change that?

Mr. KENNEDY. This is a question that is near and dear to my heart. We, in fact, had a panel at the oil spill conference in San Diego, the International Oil Spill Conference, discussing this very issue trying to come up with some resolutions, to address the legal process we are involved in.

One of the things we agreed to at this meeting with the Department of Justice represented on our panel, although not written down anywhere, is that during the operational response phase, that phase where we are having to make critical decisions based on information that may be available, we need to somehow put aside the interests of the litigation and make whatever data is being collected available to make the most intelligent decisions.

This has been our concern from the beginning that in some cases we made decisions with less than the best available data. This may be idealistic; but, in fact, this panel did agree that this is where we needed to head. In addition, there has been other discussions along these lines, that might try and institute more open access to data at some point in the future for spill response.

Mr. HERTEL. Well, I won't be too harsh because they are not here, but, of course, we held a hearing with the Justice Department. We told them that the settlement was not adequate and were inclined to say, "We told you so," but we don't get any enjoyment out of that. But I think you are going in the right direction in that assessment. Mr. Lindsey, what about this new genetic engineering for developing strains of bacteria that are far more effective in breaking down spilled oil? Can you tell us about that? And also would it be harmful in other ways? Would it pose a threat to the marine environment? How much do we know about that?

Mr. LINDSEY. OK. Just as a prelude to that, the work we did in Alaska was based on adding nutrients so that the native microorganisms could be more effective, okay? There are two other ways of dealing with bioremediation. One is to seed the area with other microorganisms which are naturally occurring microorganisms which have been adapted specifically to deal with oil in a particular case, and that is another approach.

The third is to genetically modify microorganisms so that they can be even more effective. There are questions at this point in time with regard to oil spills about how much additional benefit you can get from genetically-engineered microorganisms. I think the jury is still out on that. We have not, in fact, done any particular tests with genetically-engineered organisms at this point in the field. We have done some work in the laboratories with those kind of things. But I think the jury is out with regard to how much more benefit you can gain.

Mr. HERTEL. And my last question, Mr. Tennyson, you cited a million dollar increase in the President's 1992 budget in your statement for oil spill research. This increase is intended to make-up for the termination of a million that we lost from the American Petroleum Institute. Can you tell us why API has terminated that funding that they have done before in the past?

Mr. TENNYSON. Mr. Chairman, the original agreement with API was for three years at a million dollars per year which, basically, matched the increase the Department of the Interior was putting down beginning in 1989. That three-year commitment expires at the end of this year, basically. We have anticipated an increase in our research budget to accelerate toward the OPA funding required or mandated in the act. But at this point, we see no form of agreement with private industry to continue on beyond 1991.

Mr. HERTEL. I understand. Just overall, I will finish by following-up with that and asking all of you in your various departments, do you see a need for greater funding in any area of research or preparedness? We will start with you, Captain, and go down. And, if so—I sense that there is some need—what can you tell us here in testimony today as to specifics or percentages?

Captain JENSEN. Well, we have split the pie up for oil spill research among the various agencies so I think each of us probably could go for more funding in our particular areas. In this consolidated plan that we put together, there are various levels of funding. The first level is the base level that we would expect to get out of our normal budget process. The second level is the OPA-90 additional funding that we would be asking for. And in all areas, we are looking for additional funding; from the Coast Guard's standpoint, in the prevention areas, in the spill planning and management area, and the spill response area. There are several projects identified that could benefit from additional funding.

Mr. HERTEL. Mr. Tennyson.

Mr. TENNYSON. Mr. Chairman, there are also a couple of strategies which we have developed over the last seven years which, basically, in order to carry on to final application will need, in fact, to be evaluated in the open ocean realm. To do that is in an order of magnitude more expensive than to do it in the laboratory. And at this point, these particular strategies include primarily remote sensing, in-situ burning, and chemical treating agents.

Basically, there is not funding at this point to do this in the open ocean. But that is a critical need as far as we are concerned.

Mr. KENNEDY. Historically, you have a major spill where a number of people become interested in spill response, its fate and effects. During this time, you have a year or two of pretty fat checkbooks which are followed then by 5, sometimes 10 years of pretty lean checkbooks. Certainly, we were on those incredibly lean years prior to the *Exxon Valdez* oil spill.

In fact, the last oil spill conference held right before the *Exxon Valdez* spill occurred, a number of us who had been going for years, got together, shook our heads and said, "There is so little interest in this whole topic that we ought to sit down and seriously consider whether we even want to have an oil spill conference in the future." We have seen a number of funding cycles and the challenge right now to all of us is to try and maintain some of the funding that we have obtained during spills and in many cases increase funding.

Quite often what happens is you have a spill where you have a number of organizations tasked to respond. They respond, sometimes being reimbursed for their costs, sometimes they aren't. However, going back to my opening comments, the follow-up work

which is the research to look at specific problems that have been created or exist as a result of the spill, is not funded. We are now in that situation following the *Exxon Valdez*.

We thought with the potential settlement there would have been funding to continue to do basic research which would have helped us answer questions for the future of both Alaska and the rest of the country. The settlement did not work, and right now I am struggling on a couple of different fronts to maintain enough funding to sustain the likes of the report referenced in the invitation letter and some other basic research which looks at the longer term effects of oil from the *Exxon Valdez*. So money is always a need.

Mr. LINDSEY. All right. As a good researcher, I would always appreciate some more resources. We can certainly use it effectively. I would agree with what the other panelists have said at this point. I would point out that we have all indicated, I think, in our testimony some additional work which we plan to do at some point in time, and I submit that the level of resources has to do with how quickly we are able to accomplish that work or whether we will do it in more gradual steps. To some degree, there is also an issue of how quickly one can wrap up the work that needs to be done as well.

Mr. TENNYSON. And if I might just add one other—

Mr. HERTEL. Yes.

Mr. TENNYSON. At the present time, we have spent something close to three-quarters of a million dollars to put the OHMSETT facility, the major oil spill test facility, in Leonardo, New Jersey, back on-line. It is a Federal Government facility, and it is the only one in the country that will allow us to use full-scale equipment and other strategies with oil while in saltwater. At this point, the budgets do not support the reactivation of OHMSETT. There simply is not enough money in the collective kitty sitting at this table to put it back on-line. So that is a single-mandated responsibility in the act that is not sufficiently funded at present.

Mr. HERTEL. Well, this is all very helpful. I would like to work with you on supplemental funding. I know the committee Members share that concern. We don't like turning off the faucet in regards to the short attention span around here sometimes, and I think we have the facts we need to help you find that additional funding, even under the terrible budget agreement we are working under.

I have been involved in this issue since 1976 when I was chairman of the special panel in the Michigan legislature to consider the problem of oil spills in the future on the Great Lakes. So I think many of us on this committee realize the potential is always there. And we would like to work with you. We have been working 10 years on sealift in the Merchant Marine Subcommittee so this, I think, this need will be able to be easily understood by other Members that deal with the funding and also the authorization that we have. Mr. Bateman.

Mr. YOUNG. Mr. Chairman.

Mr. HERTEL. Yes?

Mr. YOUNG. Mr. Chairman, before this and now that you are finished, are we under the five-minute rule as far as the Members go? I want to suggest respectfully to the Chairman you can use all the

time you want, but there is about seven or eight people or nine people that if we don't limit to five minutes, we will be here all day long.

Mr. HERTEL. Yes. Normally, we are under the five-minute rule for the witnesses and for us, but today's hearing is so important that I am not going to limit people to the five-minute rule. Certainly not.

Mr. YOUNG. Well——

Mr. HERTEL. Our ranking Member is going to speak next, but if we could all be shorter than me, I think we would——

Mr. YOUNG. What I am saying, Mr. Chairman, we can always go around with a second round; but, you know, there are Members that have maybe one or two specific questions they want to ask and not—you know, it is just what I am suggesting respectfully to the Chairman, now that you are finished, that we limit the rest of us to five minutes. Then we can come around on the second round.

Mr. HERTEL. I think we will have some leeway today. I don't think anybody on this committee ever has taken too much time in the past. Mr. Bateman.

Mr. BATEMAN. All right, Mr. Chairman.

Mr. HERTEL. It is your time.

Mr. BATEMAN. I am a little curious about the testimony and statements that I have read or heard earlier concerning the compressed steam methodology in the *Exxon Valdez* cleanup. Is there any dissent from the view that that was worse than not having used that technique? Everyone agrees that that was a no-no, shouldn't have been done.

Mr. KENNEDY. One thing that never seems to come out in the press, in this preliminary, fairly detailed, complex study is that nothing should have been done. I think the study is trying to say that there needs to be some very careful attention given to the type of technique that is used to clean up a spill and you need to consider stopping a lot sooner than most people would like because at some early stages, especially with that sort of an intrusive method, you are causing damage.

Mr. BATEMAN. Well, within the range of the technology available at the time, was it clearly a bad idea?

Mr. KENNEDY. It certainly was discussed as being less than the ideal way to pursue this thing. There is no question about that. However, I think under the circumstances a number of different techniques had been tried, there still remained black oiled beaches and a tremendous amount of pressure to do something. People felt compelled, even though they felt there might be damage, to go ahead and remove the product.

Mr. BATEMAN. Then you are giving some credence to Mr. Young's proposition that this was something done as an hysterical reaction or, "For God's sake do something," and not something that was done with any astuteness even in the face of concern that it was a bad thing to do?

Mr. KENNEDY. It certainly wasn't an hysterical reaction, but I think under the circumstances those that had to make the decisions felt compelled to make a decision that showed some very definite cause and effect.

Mr. BATEMAN. What about the in-situ burning? Is that something that we ought to pursue and which is, given the horror of a major oil spill, something that clearly is relatively desirable in terms of the tradeoff of the damage from the spill versus the damage through the pollution of the air?

Mr. TENNYSON. If I might, Mr. Chairman. The MMS has been involved and a major sponsor of in-situ burning research since 1983. We just finished a series of experiments to answer precisely that question. Adjacent to Mobile Bay, onshore, we did a series of burns up to 50 by 50 feet of almost 3,000 gallons at a time. That is approaching the size that you might look at in terms of an actual spill offshore. We have found within about two miles downline that we have reached the limits of detection for pollutants using the most effective and sophisticated equipment today.

And while you may be able to follow that plume for several miles further downline visually, there is essentially nothing in it in terms of health effects. The oil that we leave in the water is very weathered. There is very little in terms of lighter ends, the more toxic elements. We are not creating anything in the airborne situation which would not be there if you chose not to burn the oil. There is a certain loss of the lighter elements of these compounds anyway. I feel that under a number of circumstances that in-situ burn allows you the opportunity to remove 50 to 95, maybe even 99 percent of the oil that you encounter using a much smaller logistical support base than you would use with mechanical recovery or with using chemical treating agents. So I think that just like bioremediation, just like dispersants, just like mechanical recovery, it has a place in the total response kit that should be allowed. And right now we are not allowed to use it.

Mr. BATEMAN. You are not allowed to use it?

Mr. TENNYSON. At this point, there was one trial allowed, I think, the third day in Prince William Sound. There were major concerns about safety and health. At this point, it is like dispersants. It is one that we keep talking about but have not been allowed to use as an actual response to a spill to date.

Mr. BATEMAN. Who prevents you from using it? Is it an act of Congress or is it a regulation and, if so, whose?

Mr. TENNYSON. Dave Kennedy has worked closer with the RRT's and so has Don Jensen. I would like to defer to them on that.

Captain JENSEN. Much like the use of dispersants, before an on-scene coordinator can in-situ burn or use dispersants, he must get approval from the EPA representative of the Regional Response Team and the affected States. As with dispersants, also, there isn't enough information that is accepted out there to make that decision in a timely fashion. Both of those techniques must be used very quickly after the spill occurs before oil weathers.

I was over in the Persian Gulf, and we tried to do an in-situ burn three weeks after the spill had occurred, down in Saudi Arabia. It was 70 percent water and was ineffective. So what we need to do is get the data out there so that people that have to make the decisions and approve those decisions can make informed decisions early on. We need that mechanism in place so that this approval process can take place in hours and not days after recommendation.

Mr. YOUNG. Will the gentleman yield?

Mr. BATEMAN. Surely.

Mr. YOUNG. Commander, if I remember correctly, we gave you that authority under the oil spill legislation this last time that there is one person, the Coast Guard, in charge of any responsibility that has taken place in a decision we view without going through any approval. Is that correct?

Captain HOLT. If I might address that, Congressman?

Mr. YOUNG. Yes.

Captain HOLT. Yes. You are absolutely right. The on-scene coordinator designated by the President is in charge of the cleanup. But, the on-scene coordinator cannot make these kinds of decisions in a vacuum. He has to rely on the advice given to him by the scientific community as to what might be——

Mr. YOUNG. I understand all that but I want to make it perfectly clear because what happened in the *Exxon Valdez*, and that keeps coming up, is we had in this case the State DEC saying, "No, you can't burn it," and you couldn't. And what happened, we had about 15 generals running around chasing their tails and nobody knew exactly what they were doing. Now, we solved that problem in that bill; and if we haven't solved it, Mr. Chairman, I want to address it. I don't want the Coast Guard to say, "Well, we haven't got all the information. We can't make a decision." We put you in charge. If we have another spill, you better make that decision and "damn the torpedoes," because if you don't, you will lose that window. That window is about that big when you have a spill.

Mr. BATEMAN. Well, at this point I want to reclaim my time because the point of my question is if you don't have authority for the people with the technical wherewithal to make the decision and implement it, we need to know about it so we can make sure that you have the authority and everybody knows you have it or that the right people have it.

Mr. HERTEL. Well, I think what Mr. Tennyson——

Mr. BATEMAN. Is there a problem there?

Mr. HERTEL. What Mr. Tennyson was saying was not the authority, it was the information. Isn't that what you said, that you would like to be able to do it on a larger scale, to experiment more to find out the effects?

Mr. TENNYSON. That is correct. We need to do it in the open ocean to fill the gap of, "Can it be done, under what conditions, and what do you have to look for?"

Mr. HERTEL. And is that the concern of the Coast Guard also? You have the authority, but you need the information?

Captain HOLT. Absolutely. During a spill is not the time to be making decisions as to whether or not a particular cleanup technique is effective or not. That is the kind of information that needs to be scoped out well in advance of the spill. Now, with regard to Coast Guard authority, all I can say is that the Oil Pollution Act gave us an awful lot of authority, and we are equal to the task; but it did not preempt the States from establishing their own oil pollution control programs. And that, quite frankly, is going to be an issue that we are going to have to come to grips with and wrestle with on each of these spills. And we are working closely with the

States to try and make sure that we can have a coordinated response.

Mr. BATEMAN. Well, I hate to be taking too much time, especially with my friend from Alaska's injunction. But, you know, this hearing is a waste of our time if we are not put in a position of responding legislatively to give the authority in abundant amount to the people who ought to have the authority to act. Of course you have to have information; but if you have the information and it dictates that the wise and discreet thing is to do a certain thing, the person in charge ought to be able to see that that is implemented and not to be vetoed by everybody from hither to there. And if that isn't the way it operates under the oil spill legislation we passed, we need to address it. We want to address it, but we need the input from you in terms of how it needs to be addressed.

I have one other question. I don't think it will take but a moment. We have talked about burning oil. I have a constituent who is a scientist and who says the way to deal with an oil spill is through a cryogenic fluid to solidify the spill so it can be carried away in solid chunks. He says that liquid nitrogen, with a boiling point of −320° F, offers probably the best tradeoff among extreme cold, cost, availability, and lack of impact on the environment, among the various cryogenic fluids available. I think I heard the word cryogenic in somebody's testimony. Is there any potential merit in what my constituent is proposing?

Mr. LINDSEY. That is essentially it. He wants to freeze it to be able to pick it up. How practical that is in the real world, I don't think I am in a position to comment. I would certainly be willing to have our people, maybe others in the research community here, take a look at his proposal.

Mr. BATEMAN. Well, if my scientist friend and constituent wanted to talk to somebody, who does he talk to? You?

Mr. LINDSEY. Sure.

Mr. BATEMAN. Thank you.

Mr. HERTEL. Thank you. I want to be clear on this. There is no question of authority. The act the Congress passed in the last session does give the authority in all these cases. What you were telling us earlier is that each of you could use additional funding in different areas largely for research. Is that correct? That is our responsibility. Mr. Pallone.

Mr. PALLONE. Thank you, Mr. Chairman. I came in late and so I apologize because I may have missed a couple of aspects of this. But I heard Mr. Tennyson talking about the OHMSETT facility which is actually in my district. And when I was reading your testimony, I got the impression, which is the one that I was under, that the facility is being reactivated and that funding is being provided. But then I heard you say just a few minutes ago that just the opposite is true, that there is no money in the budget for it. So what is the true story on it, if you could tell me?

Mr. TENNYSON. The President's budget for 1992 contained a full measure of what was necessary to operate OHMSETT for the first year. The Department of the Interior, with help from the Coast Guard and Environment Canada, put three-quarters of a million dollars into refurbishing the facility. It is ready to go. But the latest passback we have had from the House Appropriations Com-

mittee on Interior has zeroed out that increase in 1992 which, basically, leaves us, if our entire budget were put into OHMSETT, unable to afford it. Basically, at this point, there is not enough money identified in the 1992 budget—I might speak for the Coast Guard as well—to support the facility on a year-round basis.

Mr. PALLONE. So, in other words, what is in your testimony essentially applies to the current fiscal year, but you are saying that with the action that the Appropriations Committee has taken for the fiscal year 1992, whatever happens now is going to be, basically, destroyed, in effect?

Mr. TENNYSON. Well, the facility is a lot more readily available to anybody who wants to operate it now because we have refurbished it.

Mr. PALLONE. But you are not using it?

Mr. TENNYSON. But at this point there is not sufficient money to put it on-line. That is correct.

Mr. PALLONE. And unless that would change for the 1992 budget, there wouldn't be sufficient funds and you wouldn't use it for a lot of the research that you have outlined here?

Mr. TENNYSON. We have a number of research initiatives we need to do in OHMSETT, but there is not sufficient money to put it back in operation to use it. That is correct.

Mr. PALLONE. And how much are we talking about?

Mr. TENNYSON. Our identification of what was needed as a baseline for OHMSETT is $1.4 million a year.

Mr. PALLONE. In the next fiscal year?

Mr. TENNYSON. The beginning of 1992. Yes, sir.

Mr. PALLONE. So we would need $1.4 million in fiscal year 1992?

Mr. TENNYSON. That is correct.

Mr. PALLONE. What about on the Senate side? What is happening there?

Mr. TENNYSON. I don't believe the Senate has decided that issue yet.

Mr. PALLONE. And the Senate hasn't reported out the bill yet. OK. I am glad you brought that to my attention. I wasn't aware of the fact that there was a problem. I thought we were going ahead with it, and I guess the Chairman noticed it as well. Let me ask you—I mean, obviously, now that you have told me, we are going to have to do what we can to try to get the money, either in conference or whatever. There was a question about the termination of this one million dollars in funding previously provided by the American Petroleum Institute. Does that also fold into this issue as well in terms of funding, or that is a separate issue?

Mr. TENNYSON. The original agreement with American Petroleum Institute following the Prince William Sound spill was for a million dollars a year for three years. It began in 1989, and it ends this year.

Mr. PALLONE. But does that relate to the OHMSETT facility as well?

Mr. TENNYSON. API had not funded the OHMSETT specifically, but what that does is gives us enough money to continue on with the other nine program research areas that we have, in addition to OHMSETT, which would free-up money for putting into OHMSETT. With the loss of that, the decision which is still being consid-

cred within the organization is do we go ahead with the other nine research programs or program areas which were identified in the testimony, or do we bite the bullet, basically, and do the best job we can in funding OHMSETT without the money to go ahead and use the facility ourself.

Mr. PALLONE. Well, so then this is just making it worse in other words, the lack of funds from the API?

Mr. TENNYSON. The 1992 passback from Congress represents about a 50 percent cut in our budgets over 1991 levels, our overall program budget.

Mr. PALLONE. And what was the reason? I don't know if this question was asked. What was the reason why the API terminated the funding? Was that asked already?

Mr. YOUNG. It was an agreement.

Mr. PALLONE. Excuse me?

Mr. YOUNG. It was an agreement.

Mr. PALLONE. Oh, it was? OK. I don't really know much about how that funding was provided for. But, I mean, obviously, we need to do something in Congress. I was going to ask Mr. Jensen, and, again, I don't know if this has already been asked, the status of the formation of the Regional Oil Spill Response Teams. Did you give us a status report on that, Captain Jensen?

Captain JENSEN. I didn't. There are billets in the budget this year that are being filled in the various district offices to fill those teams up.

Mr. PALLONE. OK. Well, are we at the——

Captain JENSEN. They are in the process of being implemented now.

Mr. PALLONE. Is there going to be one in the port of New York/New Jersey? I mean, we were hoping for that.

Captain JENSEN. Captain Holt can give more specifics.

Captain HOLT. Thank you, sir. Yes. We have established a third strike team in New Jersey which will be on-line by the end of this summer. We have also established some additional district advisory staffs in each Coast Guard district so, in the First Coast Guard District, which covers New York, it will be covering the region from Maine to New York. And then the Fifth Coast Guard District covers part of New Jersey down to North Carolina, I believe, so there will be that body of people. Then each of our captains-of-the-port in each port area will have prepositioned equipment available and can also provide a degree of response to an oil spill. So there is a significant increase in the number of resources that have been provided to the Coast Guard for oil spill response.

Mr. PALLONE. Well, could you give us more information about the New Jersey one? Obviously, I have a parochial interest here. You said by the end of the summer?

Captain HOLT. Yes, sir. By the middle of August we hope to have the third strike team in New Jersey established.

Mr. PALLONE. Where is it going to be located?

Captain HOLT. In New Jersey. There will be an announcement made tomorrow, I believe, by the Commandant of the Coast Guard as to where it is that we are going to be setting that up.

Mr. PALLONE. OK. So you can't provide any more details at this point?

Captain Hull. I would prefer not to, sir, if you don't mind.

Mr. PALLONE. OK. Thank you, Mr. Chairman.

Mr. HERTEL. Mr. Young.

Mr. YOUNG. Do you want to ask unanimous consent for something?

Mr. FIELDS. Yes. If the gentleman would yield, Mr. Chairman, I would ask unanimous consent to put my statement in the record. I have a great interest in this issue coming from Houston, the Gulf Coast—a real interest, as the Coast Guard knows, in the prepositioning of response equipment, but I do have some conflicts today and am going to have to leave. So I would ask that my statement be included in the record.

Mr. HERTEL. Without objection.

Mr. FIELDS. Thank you.

[The statement of Mr. Fields follows:]

STATEMENT OF HON. JACK FIELDS, A U.S. REPRESENTATIVE FROM TEXAS

Mr. Chairman, I would like to compliment you and Billy Tauzin for scheduling this important oversight hearing on oil spill cleanup technologies.

As someone whose State was devastated by two major oil spills last year, I am extremely interested in learning the status of the National Contingency Plan and whether we are better prepared to deal with a major oil spill today than we were in 1990.

While fortunately our vital Texas coastline has recovered from the adverse effects of the *Mega Borg* and the *Apex Barge* accidents, the citizens of my State have come to expect, with the passage of the Oil Pollution Act, that any future oil spills will be met with lightening speed and efficiency.

It is for this reason that I am disappointed that the U.S. Coast Guard has still not announced where and how much equipment will be prepositioned in the Gulf of Mexico. With the enactment of Public Law 101-380, the expectations of those living along the Gulf have been significantly increased and they will not tolerate, nor will I, slow and ineffective cleanup efforts. It is my hope that the Coast Guard will soon preposition a significant amount of cleanup equipment in the Gulf of Mexico, which is clearly our Nation's busiest petroleum transportation region.

Mr. Chairman, I am also interested in getting the reaction of the Coast Guard, the Department of the Interior, and EPA to the comments made by NOAA's Chief Scientist, Sylvia Earle, who has stated that "The use of hot water under pressure may have done more environmental harm than good in Alaska and should be avoided in the future."

Mr. Chairman, there have been various press reports indicating that the untreated oil-fouled beaches in Alaska have recovered much more rapidly than those which were "cleaned" by the hot water treatment. I am interested in knowing from our witnesses, whether they agree with those press statements and I want them to tell us what were the best cleanup techniques used in the Prince William Sound experience.

Finally, I want to find out from our witnesses their assessment of the effectiveness of bioremediation in the cleanup of an oil spill. This procedure was used fairly extensively during the cleanup of the *Mega Borg* spill and many experts concluded that the oil-eating microbes did an effective job. In fact, certain Texas State officials have stated that bioremediation will be a primary tool used in the next major oil spill.

Mr. Chairman, I am interested in learning whether our witnesses share that optimism and what role they believe bioremediation can play in any future cleanup efforts.

Mr. Chairman, again, I compliment you for scheduling this hearing and I am anxious to hear from our distinguished witnesses.

Thank you, Mr. Chairman.

Mr. YOUNG. Thank you, Mr. Chairman. I won't ask that many questions. I have a question for Mr. Tennyson. I understand you were the U.S. Government chief investigator in joint evaluation with Canada on an oil spill control product called Elastol?

Mr. TENNYSON. Elastol. Yes.

Mr. YOUNG. I also heard these tests were successful in recovering oil off of Newfoundland and under weather conditions which everyone thought would make cleanup impossible. What is it? How does it work? What is the technology?

Mr. TENNYSON. Elastol is one of a number of chemical treating agents which we have identified and have evaluated. We used that particular product offshore of Newfoundland and Nova Scotia in 1987. Basically, it was not part of our original test plan. We had it aboard as a contingency plan.

In 1987 in Nova Scotia we did use it on intentional spills, a series of 10 five-barrel spills at sea, 150 miles due east of St. John. We used it to see whether or not it would prohibit the emulsion formation in spilled oil; that is, the incorporation of water within the oil itself which makes a recovery very difficult. And we used it to see if, in fact, it would retard the spread of oil so you wouldn't have to go over quite so much area to recover the oil. In fact, it did both. And three weeks later, we used it as a contingency on another spill we had conducted with Canada off Newfoundland, and that was in October. In that particular case, the oil we were using was a high-paraffin base oil. The high-paraffin base oil was non-amenable to recovery using the skimmers we had on-scene. We knew that beforehand. We used Elastol as a contingency measure. It changed the adhesive nature and the viscosity of the oil, the syrupy nature of the oil, so that the recovery devices worked far better.

The way it works, and the gentleman who manufactures this is in the audience behind me, so my apologies for oversimplification, but it is approximately a two million polymer molecule that attaches to the oil; as you pull on it using suction skimmers or other kinds of skimmers, you put it under strain, the oil then behaves as a function of the elasticized version of the molecule. If you will, it is a series of small springs, two million molecules or so long, with oil adhering to them. When you pull on one end of the spring, the rest of the spring comes. And that very definitely changes the behavior, fluidity, and the viscosity of oil to the benefit of mechanical recovery and perhaps to burning as well.

Mr. YOUNG. Is it toxic?

Mr. TENNYSON. Well, I would answer by saying that the majority of the product is what is used in chewing gum to make it chewy. When I used it off Newfoundland, there was a 35-knot wind blowing, and I had two men in a small boat with me. And I think we probably got two-thirds of what we were intending to put on the oil on ourselves instead. That was four years ago. I am here today, so that may have some bearing as well.

Mr. YOUNG. In simple terms, do you spray it on? Do you add it to the water, or what happens?

Mr. TENNYSON. You can use it as a powder. You can educt it into a fire monitor. You can throw it with an eight-ounce styrofoam coffee cup which is what I used. That is not generally recommended for large spills, but, basically, it is a very easy product to apply. And you can put it on the water. It does not dissolve in the water like dispersants do, and, basically, you can pretreat the area.

Mr. YOUNG. My interest in this, and Mr. Kennedy, I think, will verify this, my interest was that in the *Exxon Valdez*, if we could

have had a method to attack the problem before it ever reached the beaches, we would have had no problem. And we had some time. It wasn't as quick as people thought it was. If we could have burned it or we could have—you know, the bioremediation, that happens after it reaches the beach, I take correctly, but you are saying that you could use this to actually more effectively use skimmers and recover the oil before it ever gets onshore. Is that what you are saying?

Mr. TENNYSON. In the cases that we have used it, it has very materially increased the capabilities of existing equipment, both booms and skimmers.

Mr. YOUNG. Is it an expensive product?

Mr. TENNYSON. I have no idea of the market value, sir.

Mr. YOUNG. OK. Well, maybe I can find out who makes it because to me that is what I have been trying to seek. I wanted to burn the *Exxon Valdez* oil. Couldn't do it and we lost that window. That one short period where it is volatile enough, we lost that. And then we wanted to use a dispersant. Well, we argued we couldn't do that. And then finally it got on the beaches, and we used steam cleaners which was not the swiftest thing in the world to do. So if we can prevent it and then use something like you are talking about; I have never seen it but it is very interesting. Thank you, Mr. Chairman.

Mr. HERTEL. Thank you. Let me just follow-up Mr. Young's question briefly. Mr. Tennyson, do you need more money in that area to do this type of research also, or do you have adequate funding for experiments in this area?

Mr. TENNYSON. Over the last five years, we have gone through the literature and developed test procedures in the laboratory evaluating the effectiveness of a number of chemical treating agents. And that is briefly alluded to in the testimony. The next step, once we do the laboratory tests, is to do them in a tank, such as OHMSETT, and then to eventually go at sea and try these either in "spills of opportunity," that is somebody else provides a spill, or an intentional research spill. That phase, the at-sea phase, is exponentially more expensive than the laboratory or even the tank testing. There are insufficient budgets to do even a single at-sea test this year in 1992 under the current House passback.

Mr. HERTEL. Thank you. Mr. Taylor.

Mr. TAYLOR. Gentlemen, I am curious. What is the makeup of the fertilizer that you use for bioremediation? Does it vary with the type of environment that you are trying to address a spill in or——

Mr. LINDSEY. There are several different types of fertilizers that can be used. In Alaska, not having any previous experience, we tried several different ones. One is an oleophilic fertilizer which means that it sticks to the oil with potentially obvious benefits. And we tried that, and that was one of the ones that worked fairly well.

Another variety that we used are soluble fertilizers which can be in briquette form and with relatively slow release, or just soluble fertilizers not unlike what you may use on your lawn for that matter. And we experimented with a number of different ways of applying these fertilizers. The oleophilic fertilizer and the soluble fertilizer, two particular types that we used extensively, were then

used by Exxon with similar results. So, yes, there are two different types that you can use.

Mr. TAYLOR. And what you are telling me is that, you know, for example, I know the EPA has a full-time scientist who does nothing but try to find ways to prevent agricultural runoff into our TVA impoundments. You experienced none of the negative effects of having too much fertilizer on a body of water?

Mr. LINDSEY. We were concerned about that. We were concerned in a couple of ways. First of all, we were concerned that the ammonia that is in these fertilizers or that comes about as a result of the use of these fertilizers might reach toxic limits in the near-shore waters. So we tested that very closely. In fact, we never approached the toxic limits. We did see an increase in ammonia in the near-shore waters for a short period of time. If I remember the figures, between 7 and 57 hours after it was applied, it would peak and then it would tail off. We saw none of the eutrophication, that is blooms of algae or anything like that, that would also have been a possibility.

So we looked at those kinds of things, and in fact, we were unable to see any difference between the areas we treated and the areas that we didn't other than the buildup of ammonia for a brief period of time. And that never approached toxic limits for any of the species we were monitoring.

Mr. TAYLOR. A few years back, and it has probably been almost a decade, Time magazine had an article on an Israeli scientist who had come up with a process of releasing a certain type of bacteria in oil tankers that were traveling in ballast, that by the time they traveled either from Israel to their source of the oil or from the States back to the Middle East, it pretty effectively had removed all traces of oil from the tanks. Was the article accurate? And is that technology available? Or is it only good in a close system such as inside the hold of a ship?

Mr. LINDSEY. I am not personally familiar with that particular article. It seems to me I remember hearing something about that. I couldn't really comment on the veracity——

Mr. TAYLOR. So that practice—it is not common practice in the maritime industry today then?

Mr. LINDSEY. Not to my knowledge. [To his staff] Do—are any of you aware of it? Not to our knowledge.

Mr. TAYLOR. Thank you, Mr. Chairman.

Mr. HERTEL. Mr. Weldon.

Mr. WELDON. Thank you, Mr. Chairman, and let me thank all of you for coming today. I want to begin by following-up on the line of questioning that was being pursued by my colleague, Mr. Bateman, because I am a little dismayed. Two years ago following the Valdez oil spill, I along with Don Young and Secretary Lujan, visited the site after the incident and saw first-hand the frustration in trying to deal with the spill. We also heard both on-the-scene, at hearings and at a similar spill that occurred on the Delaware River (*Presidente Rivera*) that testing, analyzing, and researching new oil spill technologies during an oil spill incident should not take place. This should take place on its own, and yet here today I have the impression that in the case of burning, we are not taking the necessary

steps from an R&D standpoint. This was the same thing we heard a year ago. Therefore, I have to ask the same question, why?

I think the intent of Congress was to give the experts, and you are experts, the opportunity to explore every possible alternative to deal with oil spills, whether it be burning, or other technologies you described, such as containment, skimming, or other technologies. So, once again, I am going to repeat the same question. Are we doing an analysis of all various oil spill technologies that exist, and, if not, why aren't we? It baffles me that here we are a year-and-a-half, two years later and we still are not assessing all the technologies.—also, to add to the line of questioning by my colleague, Gene Taylor, I have also heard there have been at least a couple of attempts to use a coagulant that could be placed inside of the hull of a ship that would solidify the product, preventing it from leaving the ship. Are we doing anything in that area? I haven't heard that discussed yet today.

But my impression is that as a result of the oil spill legislation, the intent of Congress was to encourage you to explore every possible alternative while there was not a major disaster. What I am hearing is that we are not doing that.

Mr. TENNYSON. If I might address the in-situ burning, Congressman, we are at this point mature enough in our development of the strategy to, in fact, take it to sea. The concern now is there are two issues. One is the administration or getting permits from EPA to do the job, and that is underway. The second is the amount of money it takes to do it, and it is usually about a million-and-a-half dollars for an at-sea experiment, whether it be an in-situ burn, use of chemical treating agents, other strategies. That money simply is not available in our 1992 budget.

Mr. WELDON. Well, I think that the purpose of this hearing is for you all to come back to us and say, "OK. We have identified these potential technologies. Yet, we can't continue to pursue these for these reasons, either legislatively, or we are not permitted to continue this process, or we don't have the dollars." I think that the purpose of this hearing is to take steps necessary to allow you to pursue and develop various oil spill cleanup technologies. If that is the case and if it is a question of money, then I think that this is something that we must deal with in Congress.

Captain JENSEN. If I can address the——

Mr. WELDON. Which agency is responsible for doing that particular part of the analysis? Is it the Coast Guard or NOAA or whom?

Captain JENSEN. What we have done is look at all the various technologies that pertain to oil spill cleanup, and we have distributed them among the agencies. Each agency has taken a primary coordination lead in each of the various areas. What the agencies have done is look through what has been done in the past. Oftentimes we jump off and reinvent the wheel. So our initial step was to take a systematized look at what has been done in the past. So, our first year to year-and-a-half has been involved primarily in doing state-of-the-art surveys and learning what we need to know.

At this point, we have identified those areas that look promising. Now we are at the point where we need additional funding, and we are expecting and waiting for this OPA wedge of money to come. It has not come yet.

Mr. WELDON. OK.

Captain JENSEN. So we are poised ready to spend money in all of these various areas, and each agency can go through and give you more details, I think.

Mr. WELDON. For the record, could we get information on the various technologies that exist and are being developed and which agency has the tasking for that? Can we get that for the record? I didn't remember hearing it in the testimony or reading it. For each of the areas, which include burning and the idea of coagulants, I would like to know if something is being pursued by one of the agencies, or if that is not worth pursuing?

Mr. TENNYSON. We are involved with Canada right now looking at the ways of measuring the effectiveness of coagulants, if you will, and we are looking at new and innovative products including developing some on our own.

Mr. WELDON. So that is being done?

Mr. TENNYSON. It is being done.

Mr. WELDON. Could we get that then for the record of each of the technologies that are being pursued and the status and in terms of which agencies lead? Can we get that for the record?

Captain JENSEN. We can provide that information.

[The information follows:]

R&D TECHNOLOGIES BEING PURSUED

The Interagency Coordinating Committee on Oil Pollution Research (Interagency Committee) has prepared a draft Oil Pollution Research and Technology Plan (Research plan) as required by section 7001(b) of the Oil Pollution Act of 1990 (OPA90) [Public Law 101-380]). The draft Research Plan is presently in clearance with the 15 Federal agencies represented in the Interagency Committee. The Research Plan should be ready to send to the Department of Transportation (DOT) in August. The Secretary of Transportation will submit the Research Plan to Congress.

The draft Research Plan identifies oil pollution R&D needs and priorities in the following categories: spill prevention; spill response planning and management; spill response; fate, transport and effects of oil; and restoration and rehabilitation. Lead agencies, short descriptions and planned funding levels are indicated for every area of R&D in these categories. The draft Research Plan does not include abstracts of individual R&D projects. The purpose of the Research Plan is to identify R&D needs, gaps and overlaps and prioritize R&D by category/area to guide R&D decisions by Federal agencies represented on the Interagency Committee. OPA 90 requires a Biennial Report to Congress on accomplishments of the oil pollution R&D programs based on the Research Plan.

Mr. HERTEL. Well, more than for the record, we want to work with your staffs, and I have already talked to the ranking Member to put together a package of what is necessary in the amount of money in a cohesive package so that we can move ahead on this. So there are problems right now in the appropriations process, and we are very concerned.

Mr. WELDON. One of the other areas that I have had trouble with is, and I have dealt with a number of these incidents, by both living and having a district right on the Delaware River, is that a number of oil spills have been caused by fires and explosions on board of ships. While we tend to focus on containment and other technologies, we don't intend to focus on preventing the fire or explosion at the beginning. We have seen that in the case of *Mega Borg* and the case of the *Haaven*. I have also seen it on the Dela-

ware River with the *Edgar M. Queeric* and the *Corbuhee* and the *Elias* all of which were caused by fires and explosions.

While it is not a technology in terms of dealing with cleanup, we did attach some language in the conference report last year that addresses the need for the Coast Guard and our scientific agencies to look at ways that we can enforce requirements on vessels to prevent a disaster before it occurs. I don't know what the estimates are, but I would say it is probably in the neighborhood of 25 to 50 percent of these incidents are caused by fires and explosions on board the vessels. I would hope that as a part of your efforts that you are looking at the aspect of preventing environmental disasters before they occur. While I am a big supporter of the Coast Guard, I am not too happy with the ability to enforce some of our current regulations on foreign-flag carriers. In particular, my concern deals with extinguishment and containment of fires on vessels in order to prevent the ship from breaking apart as we have seen with some of the ones that I have mentioned.

Let me get on to my other point because that is just a statement. In terms of the prepositioning of equipment, I have some very specific questions. To begin with, how many prepositioned recovery units are we going to have nationwide. Not just the number but also when can we expect response units like those in New Jersey/New York all over the country?

Captain HOLT. There are 50 captain-of-port offices around the country as I am sure you know, sir, and each of those captain-of-port offices is being provided with some first aid response equipment. Additionally, we have identified 19 sites for an enhanced level of response equipment. Then tiered over that are the three strike teams.

Mr. WELDON. The three strike teams. OK.

Captain HOLT. Yes, sir. There is one in the Gulf Coast at Mobile, Alabama, currently; one in San Francisco, currently, both of them fully-staffed, manned, and equipped; and then the third one in New Jersey will be in place this summer. Now, I also need to add, however, that the primary responsibility for response equipment, as enumerated in the Oil Pollution Act, rests with the private sector. It was clearly stated in the Oil Pollution Act, through the vehicle of response plans for vessels and facilities, that the private sector must identify personnel and equipment necessary to respond to a worst-case spill.

For the equipment that the Coast Guard is buying, I think we are taking a very rational approach. I think Congress took a rational approach toward this whole issue by deciding that the public sector should not bear the primary responsibility—the farmer in Iowa should not bear the primary responsibility for response equipment for a spill on the Atlantic Coast—but it should be borne by the consumer or the person who is moving the product. And, we are working very diligently to get regulations out that will require an enhanced level of response equipment by the private sector.

The early manifestation of that is seen in the formation of the Marine Spill Response Corporation that has been put together by a consortium of oil companies, which will go a long way toward providing a significant increase in response equipment in this country.

Mr. WELDON. Well, the only problem that I have is that when you are talking about a foreign-flag tanker coming into one of our waterways, they may not have the same level of responsibility to react as quickly as perhaps an American company or supplier of petroleum products. One of the problems we have had on the Delaware River are the pre-arranged agreements with private sector response units that can be put into place at 2 a.m. or 3 a.m. when the spill occurs. Are all of these response teams, the 19 around, taking that into consideration? And what special considerations are being made for dealing with foreign-flag tankers which I think are the real problem that we have to be concerned about?

Captain HOLT. Yes, sir, we are particularly sensitive to that as well. I think, again, the Congress has taken care of that by requiring as part of these response plans, and this is in the Oil Pollution Act, that there be identified a qualified individual from the facility or available to the vessel who can essentially spend the money of the company and invoke these contracts that are supposed to be in place at 2 a.m. or 2 p.m. It is a very good provision in the law. We are very excited about it, and we are intent on seeing it work.

Mr. WELDON. So that is now in the process of being promulgated as a regulation?

Captain HOLT. Yes, sir. I believe it is another two years before the regulation is supposed to be out. We, however, have made it our highest priority regulatory project, and we are working on it—we hope to have a notice of proposed rulemaking out in the immediate future and then, following the Administrative Procedures Act, have that on the street as soon as we possibly can.

Mr. WELDON. OK. Just one final question. For the record, if you could provide me some information. I have learned that since we passed the Oil Spill Act that we have, in fact, driven several or perhaps more than several American transporters of petroleum products out of the business and that is now being provided by foreign-flag vessels or separately incorporated in entities offshore. If the Coast Guard could provide that for the record, I would like to know what, if any, impact you have seen in terms of the transportation of hazardous materials on water as a result of the passage of our legislation last year. Thank you.

Captain HOLT. Sir, we would be happy to provide that for you.

[The information follows:]

EFFECT OF OPA 90 ON U.S. OIL TRANSPORTERS

The Coast Guard is not aware of any American transporters of petroleum product that passage of OPA 90 has driven out of the business. The Coast Guard has not yet issued any implementing regulations under the authority of the act and none of the statutory provisions which would impact on a shipper's ability to do business have come into effect.

Given that the act and implementing regulations will apply to all vessels operating in U.S. waters, it should not give foreign shippers any financial advantage over U.S. shippers. Consequently, there is no reason to believe that there will be any immediate or substantial shift in the percentage of U.S.-flag vessels in the trade.

The volume and frequency of hazardous materials shipments appears not to have been altered as a result of the passage of OPA 90 for the same reasons. Without implementing regulations, there is simply no reason for anyone to alter their business practices at this time.

Mr. HERTEL. Mr. Goss.

Mr. Goss. Thank you very much, Mr. Chairman. We have focused a lot on Alaska and the cleanup effort, obviously, there because of the Valdez situation which caught everybody's attention. I would like to shift the focus away from Alaska. There are other parts of the world, and there are other things that are very much at risk besides the rocks and the critters and the Alaskan waters. And I am now thinking in terms of the Florida Straits.

I have heard testimony today that there is no silver bullet, that we haven't made a lot of progress on really response mechanisms that work under all circumstances let alone under even specific circumstances. And I think even though, Mr. Kennedy, I think your statement was that we should not be so driven to go so far as to pour hot water onto living creatures on the beaches, which we understand that wasn't a great solution, that the outrage and the reaction to the spill in Valdez, I would suggest, was kilotons relative to what megatons will be if we ever have a spill like that in the Florida Straits and what it would do to the Everglades system. It would absolutely destroy the mangrove forest, and I think we all know it.

So I think we are here doing the right thing, and I haven't heard anything that gives me any particular comfort today. We in Florida, with the cooperation of the Coast Guard, have come up with buffer zones, tanker-free buffer zones. I still think they are a good idea where possible to employ them with common sense in the absence of something better having come along to deal with an oil spill. Is that still bad thinking or not? And I will address it to Captain Jensen or Captain Holt.

Captain HOLT. No, sir. I don't think it is bad thinking. We are, however, as you know, working in the international arena——

Mr. Goss. I understand.

Captain HOLT [continuing]. To deal with this as well. It is a valid issue. It is one that we look at carefully. Unfortunately, it is outside the exact area of my purview so I couldn't comment on it precisely.

Mr. Goss. But my point being if you can reduce the risk areas, you may, therefore, reduce the risk. Is that accurate?

Captain HOLT. Yes, sir.

Mr. Goss. The second question I wanted to ask very briefly goes a little bit along this chain of command which was so bothersome in Valdez and is very bothersome to me. And, again, I want to give you a Florida scenario rather than an Alaskan scenario. We are not dealing, I think, so much with hysteria, with no disrespect to my colleague from Virginia because I do think that there was a lot of hysteria, and I think there will be a lot of hysteria if you have an oil spill; but I think what we are dealing with is a very strong constituent demand that says, "Look. I didn't put it there on my beach. It is ruining the tourist economy. It is ruining my beach-going pleasure. It is ruining our international travel business. It is causing airplane seats not to be sold. It is giving us a bad name on an international, very competitive tourist market basis, and I want something done about my beach. How do I get the oil off it?" Now, I would like to know if we have a response to that type of question?

Mr. BATEMAN. Would the gentleman yield on that?

Mr. Goss. Surely.

Mr. BATEMAN. I think we need to put this in context, that the response to an oil spill that is contaminating a Florida beach probably ought to be remarkably different from an oil spill that is contaminating rocks in Prince William Sound in Alaska, that you have an entirely different set of concerns and problems.

Mr. Goss. Well, I totally agree with that. That is why I wanted to change the focus and ask the question with regard to the constituents who are not the Alaskan people affected but others who maybe are more familiar with a beach experience which, I think, would include the Jersey shore and Long Island Sound and some other heavy use areas along the California coast, the Florida coast, the Gulf Coast, the North Carolina coast.

Mr. BATEMAN. Hysteria in Alaska may be different than hysteria in Florida.

Mr. Goss. I assure you, my colleague, we will have hysteria in Florida if we have an oil spill like that.

Mr. BATEMAN. That is not hysteria. That would be reasonable reaction.

Mr. Goss. Well, if you say so. I will tell them you said that, but can I have a response on that, Mr. Kennedy?

Mr. KENNEDY. Any decision on cleaning up a beach is almost always one of tradeoffs. There is never a right or a wrong answer, and it really depends on a fairly complex set of circumstances that change in each individual spill location. Certainly, the examples of Alaska and Florida are about as diverse as you can get. However, but we do find that in most spills there is a different product, a different situation, and a different type beach that are oiled. This forces us to consider each spill differently.

The one thing that we have found to begin to make some decisions which are ultimately decided made by the Coast Guard, you need to try and consult with others. If you don't, it is political suicide amongst other things, not to consult with others. Certainly the priorities change in each case, and what we have found is that on highly recreational beaches, those things which aid in a decision not to clean a beach or not to do much on a biologically-sensitive beach generally doesn't apply to a recreational beach. There is a different set of circumstances. The sand is fine and you can generally go in with equipment because the beach has been highly utilized. The oil tends not to be penetrating into the beach, and you can remove it. However, the one factor that is included in most decisions, especially in highly-populated, economically-impacted, spill-covered beaches, is the economics, the tourism, and everything else included in recreational factors in given the priority on whether or not or how you clean a beach.

Mr. Goss. What, I think, we are asking is that for the infinite variety of possibilities that we have in front of us on this matter, that we have a chain of command that works in every case. That is what I want to be assured of.

Captain HOLT. We have a chain of command. Whether it works in every case, sir, is a very difficult issue to address. And, again, to reiterate, the States were not preempted in the Oil Pollution Act from setting up their own oil pollution scheme. So, if I might turn the tables and provide you a scenario, if I am a responsible party, an owner of a vessel, and I spill oil and the Coast Guard On-Scene

Coordinator tells me, "Burn that oil," and I burn the oil, and then the State on-scene coordinator comes and tells me, "Don't burn that oil. You are going to have to find some other way to pick it up," then it becomes the choice of mine as to whether I want to go to a State prison or a Federal prison. And that is not a very comforting thought. I am sorry if I was flip on that, but that is essentially the situation that we find ourselves in.

Mr. Goss. Well, the reason I specifically asked the question is because I happen to think that the States that have been responsible and have tried to do something about this, part of that responsibility along with part of your responsibility, the Federal Government with the Coast Guard as the responsible agency, is to work those scenarios out ahead of time and to have an agreed-upon solution so that we don't go through the exact scenario that my colleague from Alaska was describing to us. And that is what I am encouraging.

Captain HOLT. And I couldn't agree with you more. The whole issue of contingency planning before an oil spill is one that is of vital concern to us. We have to do a much better job in dealing with these issues before the spill occurs so that the decision-making process is enhanced, is speeded up, and we can have the answers to the question properly determined and not need-to-agree action.

Mr. Goss. Thank you very much. Mr. Chairman, I have two additional questions. Are we going to go around again or not?

Mr. HERTEL. Sure.

Mr. Goss. Thank you. I will yield to my colleagues.

Mr. HERTEL. Mr. Carper.

Mr. CARPER. Thank you very much. Let me just raise a couple of questions. One, under the oil spill legislation that has been signed into law, we levied how much of a tax on oil? Five cents per barrel? Have we begun to collect those moneys?

Captain HOLT. Yes, sir. I understand that we have started to collect the money. I cannot give you the figure. I would be happy to provide it for the record, but there is a sizable amount of money that is currently in the Oil Spill Liability Trust Fund.

Mr. CARPER. When we say sizable amount, are we talking millions of dollars, tens of millions of dollars, or what?

Captain HOLT. We at least have $50 million that is available to use through the Oil Pollution Act for emergency response——

Mr. CARPER. All right.

Captain HOLT [continuing]. In the initiation of damage assessment study.

[The information follows:]

OIL SPILL LIABILITY TRUST FUND BALANCE

The quarterly Treasury report dated April 30, 1991 indicates that, as of that date, there was $535 million deposited in the Oil Spill Liability Trust Fund.

Mr. CARPER. All right. When the *Presidente Rivera* ran aground in the Delaware River a year or two ago, the substance that spilled into our waters was a heavier grade of crude than, I think, we were used to or prepared to work with. When the booms were put out to surround the material, we found that the material actually sank beneath the booms, and that efforts to pick it up using skimmers failed because they simply became clogged. So we know personally

of a need to do research and find ways to better clean up spilled oil. I think it was a crude oil number 6. We know there is a real need there.

We will say that $50 million has been collected to date. Just refresh my memory. How much of that money is automatically appropriated or how does the appropriation process work—it has to be appropriated, does it not?

Captain HOLT. Not the $50 million, sir. The $50 million is immediately available for our use without regard to appropriation. The additional money that may be necessary if it is a response that is being paid for by the Federal Government would have to come from the Oil Pollution Liability Trust Fund. I would be happy to provide for the record how that mechanism works. I am not equipped to answer that question right now. But we do know we have $50 million that is available for our immediate response. That, again, however, has to be read in the context that we feel that it is in the best interest of the United States for the responsible party to pay for the cleanup in the first instance, and we constantly promote that idea and push the responsible party to pay for the cleanup first. If he is incapable of paying for whatever reason, then we would clean it up unhesitatingly with that $50 million or plus, whatever is necessary.

[The information follows:]

OIL SPILL LIABILITY TRUST FUND

Up to $50 million from the Oil Spill Liability Trust Fund (OSLTF) may be made available by the President each fiscal year to carry out Federal removal actions pursuant to the authority of section 311(c) of the Federal Water Pollution Control Act and to initiate natural resources damages assessment when a spill occurs. This $50 million is not subject to annual appropriations. If this amount is inadequate for a given fiscal year, the Coast Guard would seek additional appropriations from the OSLTF.

Mr. CARPER. Let me ask you again to refresh my memory. One use of the moneys in this trust fund is to develop new technologies and to do research. Of this $50 million that we will call an automatic appropriation, can that money now be used for what I would call R&D?

Captain HOLT. Not by our interpretation of the Oil Pollution Act. That $50 million is exclusively for an emergency response. Money for research and development, for administration of the fund for putting together the strike teams and all of the other activities associated with it is part of the appropriations process.

Mr. CARPER. All right. In terms of where we are this year for fiscal year 1992 appropriations, where do we stand with the legislation? Do you know?

Captain HOLT. In terms of how much was appropriated for it?

Mr. CARPER. Yes.

Captain HOLT. No, sir, I do not know.

Mr. CARPER. Do any of our witnesses know?

Captain HOLT. I would be happy to find out and provide it for the record.

[The information follows:]

To the best of our knowledge, no fiscal year 1992 funds have been appropriated against the authorization contained in title VII of the Oil Pollution Act of 1990.

The President's budget request for fiscal year 1992 would derive a total of approximately $57.9 million from the Oil Spill Liability Trust Fund. Of this total, $31.1 million would be earmarked for operating expenses and $26.8 million for acquisition, construction, and improvements.

Mr. KENNEDY. Each individual agency has to go through its own agency to get OPA appropriations, and they are marked against our individual agencies ceilings. There are not additional funds beyond what our agencies would receive for OPA work, which has been part of our problem. We have to scrape funds together out of existing budgets to make anything happen relating to OPA.

Mr. BATEMAN. If the gentleman would yield on this——

Mr. CARPER. Yes.

Mr. BATEMAN. [continuing]. I would be very benefited by your giving us a summary of programmatic activities requested in the President's budget, any additional research programs not funded in the President's budget request, and the current legislative status of the budget for each of your agencies in the area in which we are discussing, so that we can see what we might do between now and the conclusion of the legislative process to enhance the capability to conduct the research that is needed.

Captain HOLT. If I might, sir, we would be happy to provide that. I might also add that there are numerous other agencies involved in this process that are not identified here.

[The information follows:]

SUMMARY OF R&D PROGRAMMATIC ACTIVITIES

The President's fiscal year 1992 budget request contained the following Coast Guard pollution response items:

Pollution Response Project Elements	Amount ($000)
Incident of National Significance System—determine optimum organizational structure and support system	$650
Damaged Vessel Countermeasures—complete technology review and engineering feasibility assessment for onboard tanker spill countermeasure system	$400
Oil Spill Recovery—test and evaluate Strike Team and buoy tender equipment and support Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) facility	$900
Multi-agency Hazardous Materials Spill Countermeasures—multi-agency study to assess existing and develop new countermeasures	$180
Total	$2,130

Because of the nature of the fiscal year 1992 budget process, the Coast Guard is not in a position to address the fiscal year 1992 requests of other agencies. The Interagency Coordinating Committee on Oil Pollution Research, established by section 7001 of the Oil Pollution Act of 1990 (OPA 90), has developed an implementation plan which is in final agency clearance. This plan will provide the basis for coordinating the fiscal year 1993 requests by the various agencies for appropriations that were authorized by the OPA 90.

Mr. BATEMAN. Yes. I am saying this to a multi-agency panel, not just to the Coast Guard.

Captain HOLT. Even the agencies that are represented here don't reflect the full range of Federal Government activity.

Mr. BATEMAN. Well, you panelists are smart enough to know which agencies they are and to either cajole them into furnishing it or digging it out for us. But we do need that kind of data.

Captain HOLT. Well, especially if you are going to help them.

Mr. KENNEDY. We would be happy to provide that information.

[The following information was supplied for the record:]

Question. What was NOAA's fiscal year 1992 request for moneys to support development of new technologies or information to support improved cleanup of oil spills?

Answer. No funds were requested.

Question. What additional moneys are needed that were not forwarded in the fiscal year 1992 budget?

Answer. NOAA is currently assessing its fiscal year 1992 requirements.

Question. What is the status of NOAA's fiscal year 1992 appropriations bill?

Answer. As of June 21, 1991 NOAA's appropriations bill had cleared the House and is awaiting action in the Senate.

Mr. CARPER. We are moving along on the appropriations process. In fact, we are moving more quickly than I recall in the five terms that I have been here. We are taking up the Treasury Postal Appropriations bill today. I think that is the 6th of the 13 Appropriation bills that we will be considering. I think there is a good chance we will do the seventh one tomorrow. There is a good chance we will finish all of them by the Fourth of July in the House. So to the extent that there is some information that we need to have, timeliness would be very helpful. Thank you. Thank you, Mr. Chairman.

Mr. KENNEDY. Should we direct that information to Mr. Hertel?

Mr. CARPER. I believe that would be appropriate.

Mr. HERTEL. The patient gentleman from Maryland, Mr. Gilchrest.

Mr. GILCHREST. Thank you, Mr. Chairman, something my mother taught me. It is a good injection into politics I think if you want to stay here for a while. Captain Jensen, if the *Exxon Valdez* spill happened today exactly the way it happened two years ago, what would the response be of the Coast Guard?

Captain JENSEN. It would be a lot more responsive than it was back then.

Mr. GILCHREST. Would it be burned today? Would——

Captain JENSEN. We would look at all of the techniques. The major techniques we would look at would be mechanical recovery. We wouldn't sell that short. We would be looking at use of dispersants, and we would be looking at in-situ burning. It would be a combination of all of those. We feel that in a big spill, you have got to use all the tools available, and those three certainly would be used in the early stages of that. We would also look at offloading very quickly, like we did the *Exxon Valdez*, offloading the cargo to prevent more from escaping. That is one of the unsung successes of *Exxon Valdez*, and we would certainly put emphasis on that also.

Mr. GILCHREST. So I assume the communication problem that I had seen picked up between the State and the Federal Government and the Coast Guard would be a little bit more smoothly operated at this time?

Captain JENSEN. I think around the country everyone learned from that, and all of the captain-of-the-port offices have gotten to-

gether with their State counterparts and other agencies and worked out some of these details.

Mr. CARPER. Thank you. Mr. Kennedy, is there a place for hot water treatment in the world?

Mr. KENNEDY. Oh, I think so. I was alluding to this earlier, that I don't think we want to completely rule out hot water treatment for oil spill response. There are particular instances where it probably would be used; in fact, has been used successfully. These areas are in marinas, areas of low biological sensitivity, bulkheads, riprap, manmade structures that are oiled that require special treatment or that we want to get completely clean. Those are some examples and there are probably a few others. This is one of the reasons we conducted the study: to try and generate some data so we would have a better idea of where we should and shouldn't use hot water washes. We had a pretty good inclination that the hot water, high-pressure washing was going to be damaging in Alaska, but as we discussed earlier, "Well, you mean you went ahead and did it anyway even though you thought"—well, one of our problems has always been that we have not been able to generate enough data as the result of a spill or activities taken in a spill that will corroborate one way or another whether the right decision was made. That is why the study is so important, and why we want to continue it.

Mr. GILCHREST. I see. I am not sure which person I should ask the next question to, but how much oil was recovered in the *Exxon Valdez* spill, and where did it go?

Captain JENSEN. The second part is a little easier. It went to Oregon. A lot of it was recovered with absorbent materials. It was stored up in Valdez for a while and then eventually brought down to a landfill in Oregon, I believe.

Mr. GILCHREST. There is a landfill for recovered oil?

Captain JENSEN. There are landfills around the country, and recovered oil has to go to these landfills.

Mr. GILCHREST. This is a funny question, I guess, but is oil then in the landfill biodegradable so eventually it is as if it was never there?

Captain JENSEN. It depends on the kind of landfill. I think perhaps Mr. Lindsey can address that because EPA is more involved in this area.

Mr. LINDSEY. I believe that in that particular case, the landfill in Oregon is in a dry part of the State as I understand it, and I believe it is a hazardous waste facility. Now, it would not have been absolutely required by law that it go to such a facility as I understand it. But the decision was made that the site was an adequate place to put it. Would it biodegrade over time? That depends on the conditions in the landfill and what else was there, and I don't really know in this particular case because I don't know the management technique that was used. If it was under aerobic conditions, yes, over time it would decompose.

Mr. GILCHREST. So then there is no fertilizer treatment placed on that oil once it is put in a landfill?

Mr. LINDSEY. In that particular case, I don't think so. There are other techniques where you can till waste materials into surface soils and maintain aerobic conditions and augment the bioremedia-

tion using nutrients much the same as we did on the beach. I mean, it is the same principle.

Mr. GILCHREST. I see.

Mr. LINDSEY. That can be done. And there is another technique called windrowing. If the material that you have, e.g. debris, is stackable or pilable, you can compost it. But what was done in Oregon I am not quite sure.

Mr. GILCHREST. But it is never useful again?

Captain JENSEN. Some is. Now, if you recover fresh oil like over in the Persian Gulf, I think they recovered 100,000 barrels in the first several weeks, and it was so pure that it was pumped into Saudi Aramco's tanks and processed. So it can be reprocessed if it is collected soon enough. The first part of your question was how much oil was recovered from the *Exxon Valdez*. And, typically, the best that we have ever done in a response is 10 to 15 percent. And it is in that range for *Exxon Valdez*. Pushing the limit, we might get to 20 or 25 percent if we use all of these various techniques very promptly. But historically we haven't done very well.

Mr. GILCHREST. I see. Mr. Tennyson, in your testimony you talked about research utilizing the Department of Defense Nuclear Winter computerized analogy to look at burning the oil. Could you explain that, what the similarities are there between the two?

Mr. TENNYSON. The Nuclear Defense Agency built a research program computer analysis or projection, if you will, based on how many megatons and what configuration could be cooked off in a nuclear event, nuclear war situation stopping just short of causing a nuclear winter. The beauty of that model, if there is one, deals with the fact that they are looking at discreet energy releases in a finite space in a finite time. We modified that model given that an oil spill represents about six or seven orders of magnitude less energy per given time than they were dealing with, looking at the combined behavior of multiple burn plumes as it affects being uplifted into the ionosphere and the mesosphere or depositing back on the surface.

We have pretty good models for a single point source of burn, but we do not if, in fact, in a real spill situation we most likely would be conducting multiple burns, and is there a mix or is there some effect of multiple burns that we are not anticipating. That was the basis of the model.

Mr. GILCHREST. Thank you. Just one last real quick question. If you had a spill in a marsh or wetlands, is there any idea about the type of remediation that would be the best used to recover the oil?

Mr. LINDSEY. I am not sure that I can say definitively it would be the best thing to try, but one of the areas which we would like to extend our experimental work on bioremediation to is just type of environment.

Mr. KENNEDY. We have a fairly long history of watching cleanup in marshes. We are conducting a study right now as a result of a spill that occurred in a marsh in the State of Washington where we are looking at the types of cleanup techniques that are used and trying to get a better handle on what you should and shouldn't do in a marsh.

One of the things that seems to be fairly straightforward and a common theme throughout all the cleanups that we watch, is that

an excessive amount of activity in trying to clean up a marsh quite often causes more damage and harm than leaving the marsh alone, simply due to the fact that walking on the marsh works the oil that is on the surface down into the subsurface and, in fact, encapsulates the oil and retards the natural processes that we would expect to be taking place. So, in an awful lot of cases, our recommendations at this point are that you do very little in a marsh. You would be very, very careful about how you proceed in trying to get oil out of a marsh because you quite often in this case, again, cause more damage than what you gain.

Mr. GILCHREST. Can some of the bioremediation be done by spray planes?

Mr. LINDSEY. Conceptionally, yes. It could be done that way or sprayed from shallow draft boats or things of that nature. We have done it by backpack so it can be done by a variety of ways.

Mr. GILCHREST. Thank you, gentlemen. Thank you, Mr. Chairman.

Mr. HERTEL. Now, we talked about helping before. The fund has the five-dollar-a-barrel fund. That is about $550 million. Is that what that is at? Captain?

Captain HOLT. The actual limit on the fund as I recall in the Oil Pollution Act, sir, is a billion dollars per incident. I am not sure if there is a trigger mechanism for collections or what, but I will be happy to find that out and provide that for you if you would like, sir.

Mr. HERTEL. Well, no. I am talking about the fund that has been established under the act last year. What is that funding level at now?

Captain HOLT. I am not sure. I could find out that for you. It has been collected since before the Oil Pollution Act was enacted, and I just couldn't tell you what the level of funding is right now. (See page 34.)

Mr. HERTEL. And what can that be spent on aside from cleanup?

Captain HOLT. For purposes of administration, research and development, establishing the strike teams, the national response unit, other administrative elements, and pre-staged equipment, but these are all subject to the normal appropriations process.

Mr. HERTEL. So that is the problem then.

Captain HOLT. The only part of it——

Mr. HERTEL. This money then is being used for deficit offset? I understand they are not spending all of the money. And all of the problems we have talked about today that need funding, there is money as you just pointed out that can be used in those specific areas. That is why the Congress passed the law, but it is not being appropriated.

Is that the problem, because it is being used by the Administration and the other backers of this terrible budget agreement to offset budget deficits? Now, on the other hand, they can't use it for anything else. They can either just keep it there and offset it, but then we can't use it here; or, in fact, you could use it for the needs that you have testified to today. Is that correct? They can't spend it on purchasing computers or something else. I mean, they can only use it either to offset, to let it sit there or for the needs that we have talked about today?

Captain HOLT. Yes, sir.

Mr. HERTEL. Well, good. I think we have found out what the problem is. We passed an act that was going to fund the various needs in this area of preventing and cleaning up oil spills. And some of our colleagues and people in the Administration are using that money that was collected for those reasons for budget offset. But that wasn't what it was passed for. It wasn't passed to be used as a budget offset, it was passed to deal with these problems we have talked about this afternoon. Any other comments?

Mr. TAYLOR. Just one other question.

Mr. HERTEL. Mr. Taylor.

Mr. TAYLOR. Captain Holt, I am just curious. A tanker is pulling in the Pascagoula ship channel, happens to run into an unlit barge; there is a spill in the Mississippi Sound. Who takes charge? The Coast Guard oil response team, and do they have the authority to say, "Burn it, boom it, get a dispersant in"? Is there the possibility that he is going to get potential conflicting information from NOAA or from the State of Mississippi? And I am curious if you have a response for every State, I guess, already in mind ahead of time?

Captain HOLT. The person who would be in charge is the Coast Guard captain-of-the-port for that area. He is pre-designated as the on-scene coordinator for the coastal zone, for coastal waters generally. For inland waters, EPA provides the on-scene coordinator; they are the representative of the President, and they would direct the cleanup. There is always the risk that there is going to be conflicting requirements placed on a responsible party by the State because, again, I hate to sound like a broken record, but the States were not preempted, and they could establish their own separate mechanism for requiring cleanup.

We feel that through a careful planning process by each of the captains-of-the-port in conjunction with the State, if the States are willing, that we can overcome a lot of the potential conflict that will occur during a spill. But when the spill event occurs, you are always subject to the political realities of the incident. So it would be very difficult for me to sit here and say, "Everything will be rosy in the future because we are going to be working harder on our contingency planning." I just can't give you that kind of a guarantee, nor can I say that the public is going to be happy with the way we go about cleaning up the spill because there is a public expectation about what the technology is able to do and a reality as to what we can do.

It is not unlike a house fire. Once a house fire occurs, there is going to be damage to the house. That is an undeniable fact. The same thing occurs when there is an oil spill. There will be damage to the environment. Our job is to minimize that damage and to work with all of the other agencies that have responsibility in this area so that we can make it a coordinated comprehensive response.

Mr. TAYLOR. Are you pretty comfortable that regardless of where an accident occurs there is an established agency in charge?

Captain HOLT. Without a doubt. I am confident that insofar as the Federal establishment is concerned, there is recognition that in the coastal area, the Coast Guard is in charge and for the inland

zone, the EPA is in charge. I am not so sanguine. Now I talk about the States.

Mr. TAYLOR. Well, that is my next question, Captain. Are you comfortable with enabling legislation or is there enough enabling legislation to allow you to reach intergovernmental agreements with each State? Now, fortunately, the State legislatures only meet for a given period of time. In the case of Mississippi, if something is not law by July 1st, it isn't going to be law for another year until July 1st. Are there mechanisms there, or do you require anything of this committee or the Congress as a whole?

Captain HOLT. The authority for us to enter into agreements with the States on these issues is there. I think we can do it. But it relies on the agreement of the State. It relies on the State wanting to enter into an agreement with us. And I have traveled around the country, talked to numerous State officials who are involved in these programs; and as I guess Mr. Kennedy mentioned since *Exxon Valdez*, there is a better sense of a need to cooperate. People saw what happened up in Alaska. They don't want it to happen again, and they truly want to make the system work as efficiently as it can.

We will be entering into agreements with as many States as want to. We are currently working with the State of California to try to develop a model memorandum of understanding between the State and the Coast Guard in all of these issues. We have been working with the Coastal States Organization, the Association of States Attorney Generals, and any number of States' associations trying to overcome what was, in my estimation, a significant error in the Oil Pollution Act in not preempting the States.

Mr. KENNEDY. If I could just add one thing. There is an additional concern that comes out of the States' mandates, and it is one that we are seeing more and more and more as the States begin to develop their own plans and capabilities. And what I am seeing is an awful lot of duplication of effort. We are essentially recreating response programs with the same kind of technology, the same kind of research, the same kind of people on a State/Federal level that in the event of a major spill I am afraid we are going to have two complete sets of experts and technology come to the scene that may not necessarily be very well coordinated.

We are working hard to try and get out to the States to find out what they are doing, but there is a lot of effort involved there; and this gets back to the funding issue. We generally don't have enough money to go to each State and work with them to make sure that the technology and capabilities that they are developing are somehow going to match up with and not duplicate what is already there. And there is a lot of that going on.

Mr. HERTEL. Mr. Bateman.

Mr. BATEMAN. Thank you, Mr. Chairman. Let me pursue this matter of the State/Federal relationship a little further here. I think I am hearing sort of an invitation that the Congress step in and preempt the ultimate decisionmaking process on response to an oil spill where you are dealing with the navigable waters of the United States?

Captain HOLT. You will not hear that invitation from me, sir, but I have a feeling that if we do have another catastrophic spill, and

we will, that the issue of who is ultimately in charge, the State or the Federal Government, will be decided by the courts if it is not decided——

Mr. BATEMAN. Well, isn't that kind of foolish when we sit here as a body that has certainly the constitutional power to resolve that issue beforehand, and not have it resolved by the Courts after the fact?

Captain HOLT. As an operator——

Mr. BATEMAN. Don't be timid. Aren't you really inviting us to do the reasonable thing?

Captain HOLT. As an operator who potentionally would be stuck in the middle, and as an on-scene coordinator, I could be, yes sir.

Mr. BATEMAN. Well, I find it difficult to think that the Federal Government with all its power and majesty can descend upon the backyard of my constituent, Delmas Mears, because they claim it is waters of the United States. But the United States Congress would sit here and let something like this happen, where, obviously, we are dealing with navigable waters of the United States of a paramount national concern. And somebody should be in charge, but it is left on a very ad-hoc, up-in-the-air basis.

But the real question I wanted to ask before we have to go for the quorum call and vote is, we have been invited and urged to assist the Kuwaitis with their problems, such as the oil spill due to the deliberate environmental terrorism in the Persian Gulf, and the fires. Are we using that as something of a learning experience? Are we testing techniques and methodologies in dealing with that? And where does that problem lie? And having asked the question, we really don't have time for the answer. But I would like to have your comments on that either for the record, if anyone else on the committee wants it; but if not, just furnish it to my office because I am very interested in what you are doing there, what you are learning there, and whether or not they are funding what you are doing there.

[The information follows:]

IN-SITU BURNING OF OIL AS A CLEANUP TECHNIQUE

The Minerals Management Service (MMS) has been funding research on in-situ burning of oil as a spill cleanup technique since the late 1970's. It has also been funding research on improved methods of extinguishing oil well fires using relatively small amounts of water.

The National Institute of Standards and Technology (NIST) has developed, with MMS funding, techniques to sample, analyze, and predict the behavior of airborne pollutants resulting from large oil fires. The techniques, including large lighter-than-air-balloons, along with sophisticated sampling technologies, will be employed by NIST (and co-sponsored by MMS) in evaluating the behavior and effects of airborne pollutants resulting from the intentional ignition of the hundreds of oil wells in Kuwait. These studies will provide input and verification for the MMS/NIST computer model for predicting the behavior of the pollutants resulting from large oil fires. The development of technologies and methodologies for measuring large fires represents a new field of research and a logical next step in our oil spill response research program. This effort has been supported by Environment Canada, U.S. Coast Guard, and the American Petroleum Institute.

Mr. HERTEL. Thank you. We have learned a great deal. I appreciate it. We will be in touch with you. The Coast Guard and Navigation Subcommittee Chairman Tauzin has a statement for the

record that will be included. And we will adjourn the hearing. Thank you very much.

[Whereupon, at 4:20 p.m., the subcommittees were adjourned and the following was submitted for the record:]

WALTER B. JONES, NORTH CAROLINA, CHAIRMAN
EDWARD J. MARKEY, MASSACHUSETTS
GERRY E. STUDDS, MASSACHUSETTS
AUSTIN J. MURPHY, PENNSYLVANIA
ROBERT A. BORSKI, PENNSYLVANIA
THOMAS R. CARPER, DELAWARE
WILLIAM J. HUGHES, NEW JERSEY
SOLOMON P. ORTIZ, TEXAS
CHARLES E. BENNETT, FLORIDA
THOMAS M. FOGLIETTA, PENNSYLVANIA
JENNIE M. HERTEL, MICHIGAN
WILLIAM O. LIPINSKI, ILLINOIS
HERBERT H. BATEMAN, VIRGINIA
JIM SAXTON, NEW JERSEY
HELEN DELICH BENTLEY, MARYLAND
HOWARD COBLE, NORTH CAROLINA
CLINT WILSON, PENNSYLVANIA
WALLY HERGER, CALIFORNIA
JAMES M. INHOFE, OKLAHOMA
PORTER J. GOSS, FLORIDA
ARTHUR RAVENEL JR., SOUTH CAROLINA
SONNY CALLAHAN, ALABAMA
WAYNE T. GILCHREST, MARYLAND
JOHN T. DOOLITTLE, CALIFORNIA
RANDY "DUKE" CUNNINGHAM, CALIFORNIA

U.S. House of Representatives
Committee on
Merchant Marine and Fisheries
Room 1334, Longworth House Office Building
Washington, DC 20515-6230

June 18, 1991

BACKGROUND MEMORANDUM

TO: Members, Subcommittee on Oceanography, Great Lakes and the Outer Continental Shelf and the Subcommittee on Coast Guard and Navigation.

FROM: Subcommittee Staff

SUBJ: Hearing on Oil Spill Cleanup and Restoration.

At 2 P.M., June 18th 1991, in Room 1334 Longworth House Office Building, the House Subcommittee on Oceanography, Great Lakes and the Outer Continental Shelf, and the House Subcommittee on Coast Guard and Navigation will meet jointly for a hearing to examine the current state of technology in oil spill cleanup and restoration measures. The hearing will also review current research and development efforts to identify possible areas where spill cleanup and restoration technique might be improved.

BACKGROUND

In March of this year, a study contracted by the National Oceanic and Atmospheric Administration's Hazardous Materials Section outlined the effects of high-pressure hot water cleanup of oiled beaches on Prince William Sound, Alaska, following the Exxon Valdez oil spill.

In late spring of 1989, Exxon spent some eight weeks applying the hot water treatment to approximately 400 miles of oil-contaminated shoreline. Seawater, heated to 100-140 degrees Fahrenheit and applied at 100 pounds of pressure per square inch, was effective in flushing oil from beach areas and back into the water where it could be subsequently contained and recovered. While this treatment produced aesthetically "cleaner" beach sites, it also proved to be highly lethal to shoreline plant and animal communities.

The hot water treatment caused a 60-100% dieoff of these species in less than three hours of exposure and these biotic communities may require up to 10 years to recover to pre-spill conditions. By contrast, untreated, oil-contaminated beach areas are recovering more rapidly and now have plant and animal

communities that are more similar to undisturbed areas. In short, the damage caused by hot water cleanup procedures proved more harmful to shoreline plant and animal communities than the oil spill alone.

Additionally, a 1990 study contracted by the Alaska Oil Spill Commission determined that an oil spill similar to the Exxon Valdez spill could be expected to occur every 13 years (or every 11,600 transits) under circumstances existing prior to the spill within the Valdez tanker trade.

In light of the above findings, there is a critical need for more effective, yet less destructive oil spill cleanup and restoration measures. The objective of the hearing is to more clearly define this need and associated steps needed to fulfill it. Invited witnesses will include representatives from federal and state agencies, and private industry who will report on state-of-the art and recent advances in oil spill cleanup and restoration technology.

CURRENT ISSUES

Section 4201(b) of the Oil Pollution Act of 1990 amends the Clean water Act provisions requiring the President to prepare and publish a National Contingency Plan (NCP) for removal of oil and hazardous substance discharges. The purpose of the NCP is to provide for efficient, coordinated, and effective action to minimize damage from oil and hazardous substance discharges. The NCP must be updated not later than one year of enactment of the OPA '90 to include the amendments made by OPA'90. The NCP must address procedures and techniques to be used in identifying, containing, dispersing, and removing oil and hazardous substances. It must also include a schedule, prepared in cooperation with the states which identifies dispersants, other chemicals, and other spill mitigating devices and substances that may be used in carrying out the NCP. The schedule should identify those waters where the dispersants, chemicals or other substances may be used and the quantities which may be used. The provision gives this same authority to the President to be used on a case by case basis.

o NCP Status

What progress has been made in the preparation and publication of the National Contingency Plan? What is the status of revisions of the Plan?

- Approved Dispersants, Other Chemicals and Substances

What types of dispersants, other chemicals, or other substances are currently approved for use as part of the NCP?
What changes in the use of dispersants, other chemicals, or other substances are under consideration as part of the revision of the NCP?

Title 7 of the Oil Pollution Act of 1990 (P.L. 101-380) provides for the establishment of an Oil Pollution Research and Development Program coordinated by an Interagency Committee composed of Federal agencies working in cooperation with industry, universities, State governments, and other nations, as appropriate.

- Research and Development Plan

What is the current status of an Oil Pollution Research and Development Plan for implementing oil pollution research, development, and demonstration projects as outlined in subsection (c), Section 7001 of P.L. 101-380.

- Current State of Knowledge

What is the current state of knowledge of oil pollution prevention, response and mitigation technologies and of the effects of oil pollution on the marine environment?

- Significant Oil Pollution Research Gaps

Do serious gaps exist in our current knowledge of oil pollution prevention, response and mitigation technologies. What are these gaps and how can they be filled?

- Priorities and Goals for Oil Pollution R&D

What are the most critical immediate and long-term research and development goals for gaining an increased understanding of the environmental impact of oil pollution. How will this understanding improve our prevention, response, or mitigation of the environmental impact of oil pollution?

- Resource Needs

At present, what resources are being dedicated to oil pollution research and development? Are these resources adequate? If not, what additional resources are needed?

- o Regional, State Coordination of R&D

What progress has been made in identifying and implementing cooperative oil pollution research and development efforts with States or regions?

- o New or Improved Technology

What new or improved technology (mechanical, chemical, biological) is available for oil spill cleanup, and subsequent rehabilitation and restoration of contaminated marine habitats?

- o Evaluating Long-term Effects Oil Spill Cleanup and Restoration Measures

What are the ongoing and planned activities for evaluating long-term effects of oil pollution, and cleanup and restoration measures on marine environments?

US Department of Transportation
United States Coast Guard

Commandant
U.S. Coast Guard

2100 Second Street S.W.
Washington, DC 20593-0001
Staff Symbol:
Phone:

DEPARTMENT OF TRANSPORTATION

U. S. COAST GUARD

STATEMENT OF CAPTAIN DONALD S. JENSEN

ON OIL SPILL CLEANUP TECHNOLOGY

BEFORE THE SUBCOMMITTEE ON OCEANOGRAPHY, GREAT LAKES AND

THE OUTER CONTINENTAL SHELF

AND

SUBCOMMITTEE ON COAST GUARD AND NAVIGATION

COMMITTEE ON MERCHANT MARINE AND FISHERIES

HOUSE OF REPRESENTATIVES

18 JUNE 1991

CAPTAIN DONALD S. JENSEN

U.S. COAST GUARD

Captain Jensen is Chief, Applied Science Division and Acting Chief, Applied Engineering Division, U.S. Coast Guard Research and Development Center, Groton, CT. He reported to this assignment in July 1988. His previous assignment was Commanding Officer, Marine Safety Office Providence, RI.

Captain Jensen graduated from the U.S. Coast Guard Academy in 1965 and holds post-graduate level degrees in Naval Architecture/ Marine Engineering and Mechanical Engineering from the University of Michigan.

Captain Jensen has gained broad experience during his 26 years of Coast Guard service. Assignments in the Marine Safety program include tours at Marine Safety Office Providence, Marine Inspection Office Baltimore, the Atlantic Strike Team and the Marine Safety Staff of the Commander, Fifth Coast Guard District. He has had two assignments in the Coast Guard's Research and Development program. Captain Jensen's Coast Guard sea duty includes engineering tours aboard an icebreaker, an ocean station vessel and a high endurance cutter.

In his present assignment, he is responsible for the technical direction of research and development efforts underway in support of all of the Coast Guard's operational and support programs. Following the EXXON VALDEZ incident, he organized the public affairs and protocol functions for the Federal On-Scene Coordinator. Captain Jensen was actieve in the development of an interagency oil spill research program mandated by OPA 90. Most recently he was selected to serve as Chief of the U.S. Interagency Assessment Team dispatched to advise the Government of Saudi Arabia immediately following the Persian Gulf oil spill.

Captain Jensen is under orders to serve as Commanding Officer of the National Strike Force Coordination Center to be established during Summer 1991 in Elizabeth City, NC. He will report to that assignment in July 1991.

CAPTAIN WILLIAM F. HOLT

U.S. COAST GUARD

Captain Holt is presently serving as the Chief, Marine Environmental Protection Division, Coast Guard Headquarters, Washington, DC, where he is the manager for the Coast Guard's Marine Environmental Protection Program, and one of the primary officers charged with implementing the Oil Pollution Act of 1990. He has had a variety of operational and staff assignments in his 22-year career. After graduation from the Coast Guard Academy in 1968, he served on board the High Endurance Cutters Casco and Owasco, the Buoy Tender Mariposa, and commanded the Cutter Cape Fairweather. Following his service at sea, Captain Holt was assigned to the Environmental Coordination Branch at Coast Guard Headquarters followed by assignments as the alternate Captain of the Port in Sault Ste. Marie, Michigan, Chief of the Environmental Protection Division for the Third District in New York, and Supervisory Inspector for the Coast Guard's Marine Inspection Office in New York City. His most recent assignment was as Commanding Officer of the Marine Safety Office in Huntington, West Virginia.

Captain Holt was awarded a Master of Science Degree in Natural Resource from the University of Michigan in 1975. His military decorations include 2 Coast Guard Commendation Medals and the Coast Guard Achievement Medal.

He is married to the former Valerie Zucker of Arlington, Mass and they have 4 children.

DEPARTMENT OF TRANSPORTATION
U.S. COAST GUARD
STATEMENT OF CAPTAIN DONALD S. JENSEN
ON OIL SPILL TECHNOLOGY
BEFORE THE SUBCOMMITTEE ON OCEANOGRAPHY, GREAT LAKES AND
THE OUTER CONTINENTAL SHELF
AND
SUBCOMMITTEE ON COAST GUARD AND NAVIGATION
COMMITTEE ON MERCHANT MARINE AND FISHERIES
HOUSE OF REPRESENTATIVES
JUNE 18, 1991

GOOD MORNING CHAIRMEN AND DISTINGUISHED MEMBERS OF THE SUBCOMMITTEES. I AM CAPTAIN DONALD S. JENSEN, CHIEF OF THE APPLIED ENGINEERING DIVISION OF THE COAST GUARD RESEARCH AND DEVELOPMENT CENTER. WITH ME IS CAPTAIN WILLIAM F. HOLT, CHIEF OF THE MARINE ENVIRONMENTAL PROTECTION DIVISION OF COAST GUARD HEADQUARTERS.

THE TOPIC OF DISCUSSION TODAY IS THE CURRENT STATE OF OIL SPILL CLEANUP TECHNOLOGY. THIS INCLUDES A RANGE OF RESPONSE ACTIONS WHICH BEGIN WITH STABILIZING THE VESSEL AND OFFLOADING REMAINING CARGO, REMOVING THE OIL FROM THE SURFACE OF THE WATER IF IT ESCAPES FROM THE SHIP, AND MONITORING SHORELINE CLEANUP IF THE OIL REACHES THE SHORE.

OIL SPILL CLEANUP TECHNOLOGY BECAME THE FOCUS OF ATTENTION FOLLOWING THE EXXON VALDEZ OIL SPILL ON 24 MARCH 1989, WHEN GOVERNMENT AND INDUSTRY APPEARED INCAPABLE OF CLEANING UP A MAJOR SPILL IN AN ENVIRONMENTALLY-SENSITIVE AREA. THE TECHNIQUES USED IN THE EXXON VALDEZ CLEANUP, AND IN THE CLEANUP OF SUBSEQUENT

MAJOR SPILLS, WERE OFTEN DESCRIBED AS "PRIMITIVE." UNFORTUNATELY, THIS ASSESSMENT OVERLOOKED THE VAST QUANTITY OF OIL SPILLED, THE EVEN LARGER QUANTITY OF OIL THAT WAS SUCCESSFULLY REMOVED FROM THE VESSEL, THE ALMOST INSTANTANEOUS RELEASE, AND THE COMPLEX LOGISTICS INVOLVED IN MOUNTING A RESPONSE EFFORT OF THIS MAGNITUDE IN ALASKA.

FOLLOWING THE EXXON VALDEZ SPILL, STUDIES WERE INITIATED BY THE GOVERNMENT ACCOUNTING OFFICE, THE CONGRESSIONAL OFFICE OF TECHNOLOGY ASSESSMENT (OTA), THE CENTER FOR MARINE CONSERVATION, AND THE NATIONAL RESPONSE TEAM TO EXAMINE SHORTCOMINGS IN THE RESPONSE EFFORT. ALL THE STUDIES CITE THE NEED FOR UPGRADED RESPONSE TECHNOLOGIES. THE OTA REPORT ON THE SUBJECT, "COPING WITH AN OILED SEA," PRESENTED A COMPREHENSIVE AND OBJECTIVE PERSPECTIVE ON THE STATE OF OIL SPILL RESPONSE TECHNOLOGY. THE OTA REPORT CLEARLY RECOGNIZED THAT RESPONSE EFFECTIVENESS IS NOT SOLELY DEPENDENT ON INDIVIDUAL CLEANUP TECHNIQUES AND EQUIPMENT, BUT RATHER DEPENDS ON ALL ASPECTS OF A TOTAL RESPONSE EFFORT INCLUDING SOUND DECISION-MAKING THROUGH EFFECTIVE CONTINGENCY PLANNING AND ADEQUATE TECHNICAL INFORMATION, ADEQUATE LOGISTICS TO MOBILIZE AND SUPPORT CLEANUP PERSONNEL AND EQUIPMENT ON SCENE, AND PROPER TRAINING IN ADVANCE OF THE SPILL.

IN AUGUST OF 1989, THE COAST GUARD UNDERTOOK A SURVEY OF THE CURRENT TECHNOLOGY TO IDENTIFY CAPABILITIES LACKING IN RECENT RESPONSES AND TO DETERMINE WHERE TECHNOLOGICAL INITIATIVES MIGHT IMPROVE THESE CAPABILITIES. FOLLOWING THIS PRELIMINARY REVIEW,

THE COAST GUARD SPONSORED AN AD-HOC FEDERAL INTERAGENCY PLANNING WORKSHOP ON OIL SPILL RESEARCH AND DEVELOPMENT, WHERE PARTICIPANTS FROM GOVERNMENT AND INDUSTRY MET TO EXCHANGE INFORMATION, STRENGTHEN WORKING RELATIONSHIPS, AND INITIATE THE DEVELOPMENT OF A COORDINATED NATIONAL R&D EFFORT TO IMPROVE OIL SPILL RESPONSE TECHNOLOGY. PERHAPS THE MOST SIGNIFICANT OUTCOME OF THE WORKSHOP WAS A COORDINATED FIRST-ATTEMPT AT IDENTIFYING TECHNOLOGICAL DEFICIENCIES AND R&D INITIATIVES FOR THE FUTURE. THE AD-HOC COMMITTEE FORMED AT THIS WORKSHOP HAS SINCE BEEN FORMALIZED BY TITLE VII OF THE OIL POLLUTION ACT OF 1990 (OPA 1990) AS THE "INTERAGENCY COORDINATING COMMITTEE ON OIL POLLUTION RESEARCH."

SINCE THE EXXON VALDEZ SPILL, THE COAST GUARD HAS INITIATED A COMPREHENSIVE R&D PROGRAM IN MARINE ENVIRONMENTAL RESPONSE. IN THE AREA OF SPILL PLANNING AND MANAGEMENT, THE COAST GUARD, IN COOPERATION WITH NOAA, HAS DEVELOPED A PROTOTYPE SPILL RESPONSE DECISION SUPPORT SYSTEM FOR OIL AND HAZARDOUS CHEMICAL SPILL RESPONSE THAT IS PRESENTLY IN THE TESTING AND EVALUATION PHASE OF DEVELOPMENT. THIS PROTOTYPE DECISION SUPPORT SYSTEM IS DESIGNED TO PROVIDE ACCURATE AND ACCESSIBLE TECHNICAL INFORMATION TO THE COAST GUARD FEDERAL ON-SCENE COORDINATORS AND NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) SCIENTIFIC SUPPORT COORDINATORS TO ENHANCE RAPID AND SOUND DECISION MAKING DURING A SPILL. WE ARE ALSO DEVELOPING ADDITIONAL TECHNICAL DATABASES WITH NOAA, AND INITIATING PROJECTS TO UPGRADE, STANDARDIZE, AND SUPPORT OUR RISK ASSESSMENT AND CONTINGENCY PLANNING PROCESS.

THESE EFFORTS WILL INSURE IMPROVED SPILL RESPONSE PLANNING, ORGANIZATION, MANAGEMENT, AND TRAINING.

IN THE AREA OF SPILL SURVEILLANCE, WE ARE WORKING WITH OTHER U.S. AND CANADIAN AGENCIES AS WELL AS PRIVATE INDUSTRY, TO PROVIDE CRITICALLY-NEEDED DAY/NIGHT, ALL-WEATHER OIL SPILL SURVEILLANCE CAPABILITY THROUGH DEVELOPMENT OF ADVANCED OIL SPILL SENSORS. THIS SYSTEM IS REQUIRED STRATEGICALLY, TO MAP THE AREA AND MOVEMENT OF THE SPILL, AND TACTICALLY, TO DIRECT CLEANUP EQUIPMENT TO AREAS OF HIGH OIL CONCENTRATION. ALTHOUGH RESEARCH, DEVELOPMENT, TESTING AND EVALUATION OF THESE SENSORS WILL TAKE TIME, THEIR INTEGRATION INTO AN OPERATIONAL SYSTEM WILL GREATLY ENHANCE OUR CURRENT CAPABILITY. WE ARE ALSO LOOKING AT NEAR-TERM MODIFICATIONS IN OUR CURRENT HU-25 "GUARDIAN" AIRCRAFT AIREYE SYSTEM, INCLUDING SENSOR UPGRADES AND ADDITION OF STATE-OF-THE-ART DATA ANALYSIS AND TRANSMISSION CAPABILITIES.

THE COAST GUARD IS ALSO CONCENTRATING IN THE AREA OF TANKER COUNTERMEASURES TO DEVELOP IMPROVED METHODS AND EQUIPMENT TO ASSESS DAMAGE TO THE TANKER, STABILIZE THE VESSEL, AND REMOVE REMAINING CARGO BEFORE IT CAN SPILL. THESE ARE OFTEN THE CRITICAL FIRST RESPONSE EFFORTS UNDERTAKEN BY OUR STRIKE TEAMS DURING A SPILL. ONE OF THE ENCOURAGING ASPECTS DURING THE EXXON VALDEZ INCIDENT WAS THE SUCCESSFUL REMOVAL OF 80 PERCENT OF THE REMAINING OIL FROM THE TANKER. ACCORDINGLY, WE HAVE INITIATED EFFORTS TO UPGRADE THE AIR DEPLOYABLE ANTI-POLLUTION TRANSFER SYSTEM (ADAPTS) OIL OFFLOADING SYSTEM, AND ARE INVESTIGATING

ADVANCED TECHNOLOGIES TO ASSESS TANKER DAMAGE AND STEM THE FLOW OF OIL THROUGH HULL PENETRATIONS. WE ARE ALSO REVISITING THE TECHNOLOGY FOR ONBOARD TANKER COUNTERMEASURES AND CLEANUP SYSTEMS TO SUPPORT THE REQUIREMENTS OF OPA 1990.

THE OTA REPORT INDICATED THAT NO MORE THAN 30 PERCENT OF A MAJOR OIL SPILL COULD BE RECOVERED USING MECHANICAL MEANS UNDER IDEAL CONDITIONS, AND THAT PROBABLY LESS THAN HALF THAT AMOUNT IS MORE LIKELY. WE AGREE IT IS ALSO UNLIKELY THAT SUBSTANTIAL IMPROVEMENTS CAN BE MADE IN MECHANICAL CONTAINMENT AND RECOVERY SINCE BOOMING AND SKIMMING TECHNOLOGIES ARE ALREADY FAIRLY ADVANCED, AND ARE DOMINATED BY THE PHYSICS OF OIL BEHAVIOR IN THE OCEAN ENVIRONMENT. THE DYNAMICS OF SPILLED OIL IN THE ENVIRONMENT IS SIMILAR TO THE GENIE THAT IS RELEASED FROM THE LAMP; ONCE IT IS OUT, IT IS HARD TO RETURN IT TO ITS LAMP, OR FOR SPILLED OIL, TO ANOTHER TANKSHIP.

EACH OF THE VARIOUS TECHNIQUES FOR CONTROLLING OIL POLLUTION HAS POSITIVE AND NEGATIVE ATTRIBUTES. DISPERSANTS OFFER THE OPPORTUNITY TO FACILITATE NATURAL PROCESSES BUT AT THE RISK OF AFFECTING ORGANISMS IN THE WATER COLUMN. BIOREMEDIATION SIMILARLY FACILITATES THE NATURAL PROCESSES, BUT AT A SPEED AND EFFICIENCY THAT LIMIT ITS UTILITY IN "FIRST" RESPONSE. BURNING MAY EFFICIENTLY REMOVE OIL BUT IT ADDS AIR POLLUTANTS.

DESPITE ITS INEFFICIENCIES, MECHANICAL CONTAINMENT AND RECOVERY REMAINS THE PREFERRED METHOD OF OIL SPILL RESPONSE OVER THE WIDE

RANGE OF POSSIBLE CONDITIONS AND LOCATIONS OF AN OIL SPILL. SOME PROGRESS CAN BE MADE IN DEVELOPING BETTER EQUIPMENT AND TECHNIQUES TO STREAMLINE MECHANICAL RECOVERY OPERATIONS, PARTICULARLY FOR DEBRIS-HANDLING, OIL/WATER SEPARATION, TEMPORARY STORAGE, AND OIL DISPOSAL. WE ARE CURRENTLY INITIATING RESEARCH EFFORTS TO UPGRADE OIL/WATER SEPARATION AND TEMPORARY STORAGE TECHNOLOGY. EVEN THOUGH WE CANNOT ANTICIPATE SIGNIFICANT IMPROVEMENTS IN THE OVERALL PERCENTAGE OF OIL RECOVERED DURING MAJOR SPILLS, WE WILL BE BETTER ABLE TO RECOVER LIMITED AMOUNTS OF OIL TO PROTECT ENVIRONMENTALLY AND ECONOMICALLY SENSITIVE RESOURCES DURING MAJOR SPILLS, AND TO EFFECTIVELY RECOVER SMALLER SPILLS. IN ADDITION, WE ARE WORKING WITH THE MINERALS MANAGEMENT SERVICE (MMS), NAVY, AND "ENVIRONMENT CANADA" TO REOPEN THE OIL AND HAZARDOUS MATERIALS SIMULATION AND EVALUATION TESTING TANK (OHMSETT) FACILITY IN NEW JERSEY, WHERE MECHANICAL RECOVERY EQUIPMENT CAN BE TESTED USING STANDARD PROTOCOLS TO CLEARLY DEFINE THE CAPABILITIES OF THESE SYSTEMS. THIS WILL ALLOW US TO BETTER JUDGE THE ADEQUACY OF CONTINGENCY PLANS.

OF THE VARIOUS TECHNIQUES FOR REMOVING OIL FROM THE WATER, IN-SITU BURNING HOLDS THE MOST PROMISE FOR RESPONDING TO CATASTROPHIC SPILLS IN OPEN WATERS. ON THE SECOND DAY FOLLOWING THE EXXON VALDEZ SPILL, APPROXIMATELY 15,000 TO 30,000 GALLONS OF OIL WERE SUCCESSFULLY BURNED WITH AN ESTIMATED EFFICIENCY OF 98 PERCENT. WE ARE NOW PARTICIPATING IN AN AGGRESSIVE GOVERNMENT/INDUSTRY RESEARCH EFFORT TO THOROUGHLY INVESTIGATE THE OVERALL EFFECTIVENESS AND ENVIRONMENTAL EFFECTS OF IN-SITU

BURNING. MEDIUM-SCALE TESTS HAVE JUST BEEN COMPLETED AT THE COAST GUARD FIRE & SAFETY TEST FACILITY IN MOBILE, ALABAMA, WITH ENCOURAGING RESULTS. HOWEVER, OFFSHORE FULL-SCALE TESTS ARE NOW REQUIRED TO FURTHER MEASURE EFFECTIVENESS AND ENVIRONMENTAL EFFECTS, AND REFINE THE LOGISTICS AND SAFETY PROCEDURES FOR EMPLOYING THIS TECHNIQUE.

CHEMICAL COUNTERMEASURES, SUCH AS DISPERSANTS, SURFACTANTS, ELASTOMERS, AND GELLING AGENTS, ARE ANOTHER IMPORTANT TECHNOLOGY FOR DEALING WITH MAJOR SPILLS, PARTICULARLY IN PROTECTING SENSITIVE RESOURCES OR ENHANCING MECHANICAL RECOVERY. WE ARE NOT UNDERTAKING RESEARCH AND TESTING EFFORTS ON OUR OWN SINCE THE ENVIRONMENTAL PROTECTION AGENCY (EPA) AND MMS ARE TAKING THE LEAD IN THIS AREA. WE ARE COMPILING A COMPREHENSIVE DATA BASE ON CHEMICAL COUNTERMEASURES TO CAPTURE THE AVAILABLE INFORMATION ON TOXICITY, EFFECTIVENESS, AND APPLICATION PROCEDURES. THIS WILL ALLOW THE ON-SCENE COORDINATOR (OSC) TO IDENTIFY THOSE SITUATIONS WHERE CHEMICAL COUNTERMEASURES CAN BE USED, AND WHICH PRODUCT MIGHT BE MOST EFFECTIVE.

VARIOUS AGENCIES' RESEARCH IN SHORELINE CLEANUP IS BEING MONITORED BY THE COAST GUARD WITH GREAT INTEREST. WE ARE PROVIDING FUNDING FOR THE CURRENT NOAA STUDY ON THE EFFECTS OF SHORELINE CLEANUP IN PRINCE WILLIAM SOUND. PRELIMINARY RESULTS OF THIS STUDY INDICATE THAT THE MECHANICAL SHORELINE CLEANUP METHODS WHICH WERE EMPLOYED THERE REMOVED SOME OF THE OIL, BUT ONLY AT CONSIDERABLE COST TO SHORELINE ECOSYSTEMS. THE USE OF

BIOREMEDIATION WAS SOMEWHAT MORE PROMISING AS A NON-INTRUSIVE SHORELINE CLEANUP TECHNIQUE AS DOCUMENTED IN THE EPA/EXXON BIOREMEDIATION PROJECT. THIS PROMPTED THE EPA TO FOCUS R&D EFFORTS IN THIS AREA.

WE ARE CURRENTLY COORDINATING THE ABOVE EFFORTS THROUGH THE INTERAGENCY COORDINATING COMMITTEE ESTABLISHED UNDER TITLE VII OF OPA 1990. THIS COMMITTEE, CHAIRED BY THE COAST GUARD, HAS WORKED DILIGENTLY OVER THE PAST YEAR TO DEVELOP A COMPREHENSIVE FIVE-YEAR FEDERAL OIL SPILL R&D PLAN. INTERAGENCY SUBCOMMITTEES HAVE DEVELOPED THE FIVE MAIN SECTIONS OF THE PLAN: PREVENTION; SPILL PLANNING AND MANAGEMENT; SPILL RESPONSE; FATE AND EFFECTS; AND RESTORATION. THE DRAFT PLAN HAS BEEN REVIEWED BY THE NATIONAL ACADEMY OF SCIENCES AND THE STATE REPRESENTATIVES ON THE REGIONAL RESPONSE TEAMS, AND IS UNDERGOING FINAL AGENCY REVIEW. WE ANTICIPATE THE PLAN WILL BE SUBMITTED TO CONGRESS IN THE NEAR FUTURE. CONCURRENTLY, THE COMMITTEE IS ADDRESSING MECHANISMS TO IMPLEMENT THE REGIONAL GRANTS PROGRAM AND DEMONSTRATION PROJECTS CALLED FOR BY OPA 1990.

INTERNATIONALLY, THE UNITED STATES RECENTLY PARTICIPATED IN CONCLUDING AN INTERNATIONAL AGREEMENT ON OIL POLLUTION PREPAREDNESS, RESPONSE AND COOPERATION (OPRC). THE OPRC AGREEMENT, WHICH WAS DEVELOPED UNDER THE AUSPICES OF THE INTERNATIONAL MARITIME ORGANIZATION (IMO) AND SIGNED BY OVER 90 COUNTRIES, ESTABLISHES A FRAMEWORK FOR COOPERATION IN DEVELOPING ENHANCEMENTS IN TECHNOLOGIES AND TECHNIQUES FOR THE HOST OF

ACTIVITIES ASSOCIATED WITH OIL SPILL RESPONSE. IT ENCOURAGES COUNTRIES TO PARTICIPATE IN INTERNATIONAL SYMPOSIA AND TO ESTABLISH LINKS BETWEEN RESEARCH INSTITUTIONS. IT ALSO PROMOTES THE DEVELOPMENT OF INTERNATIONAL STANDARDS FOR COMPATIBLE TECHNIQUES AND EQUIPMENT.

IN SUMMARY, WE ARE NOT SUGGESTING THAT TECHNOLOGICAL INITIATIVES AND SUCCESSES CAN GUARANTEE THE COMPLETE MITIGATION AND CLEANUP OF A CATASTROPHIC OIL SPILL. THERE IS NO PANACEA NOW OR IN THE FORESEEABLE FUTURE FOR OIL SPILLED ON THE WATER. A CATASTROPHIC SPILL OF THE NATURE AND MAGNITUDE OF THE EXXON VALDEZ SPILL CAN ALWAYS RESULT IN SIGNIFICANT ENVIRONMENTAL DAMAGE. WE DO ANTICIPATE THAT A COORDINATED INTERAGENCY AND INDUSTRY R&D PROGRAM WILL SUBSTANTIALLY IMPROVE OUR ABILITY TO RESPOND TO MAJOR SPILLS, AND PERHAPS ELIMINATE ENVIRONMENTAL DAMAGE FROM SMALLER ONES. HOWEVER, TECHNOLOGICAL PROGRESS CAN BE ACHIEVED ONLY THROUGH A SUSTAINED FEDERAL OIL SPILL R&D PROGRAM, WHICH INCLUDES SEA-TESTING OF VARIOUS TECHNIQUES AND EQUIPMENT TO FULLY DEFINE THEIR CAPABILITIES.

GIVEN THE DYNAMICS OF THE OCEANS, THE PHYSICAL AND CHEMICAL PROPERTIES ASSOCIATED WITH VARIOUS OILS SPILLED, AS WELL AS THE LOGISTICAL PROBLEMS ASSOCIATED WITH MOVING MASSIVE AMOUNTS OF OIL RECOVERY EQUIPMENT TO A REMOTE SPILL SITE, PRESENT A CHALLENGE. THE MOST PRUDENT APPROACH TO PROTECTING THE OCEAN ENVIRONMENT IS PREVENTION. PREVENTION HAS BEEN AND WILL REMAIN A COAST GUARD PRIORITY. AS I MENTIONED EARLIER, IF WE CAN KEEP THE GENIE IN

THE LAMP, WE HAVE DONE AN EFFECTIVE JOB OF PROTECTING THE OCEAN ENVIRONMENT.

I FEEL THAT THE APPROACH BEING TAKEN BY THE RESEARCH AND DEVELOPMENT COMMUNITY IS SOUND, COMPREHENSIVE, AND SHOULD BE SUPPORTED IN THE FUTURE.

STATEMENT OF
DAVID M. KENNEDY
ACTING CHIEF, HAZARDOUS MATERIALS RESPONSE BRANCH
NATIONAL OCEAN SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

BEFORE THE

COMMITTEE ON MERCHANT MARINE AND FISHERIES
SUBCOMMITTEE ON OCEANOGRAPHY AND GREAT LAKES
SUBCOMMITTEE ON COAST GUARD AND NAVIGATION
U.S. HOUSE OF REPRESENTATIVES

JUNE 18, 1991

MR. CHAIRMEN AND MEMBERS OF THE SUBCOMMITTEES:

WE IN NOAA ARE GRATEFUL FOR THIS OPPORTUNITY TO TESTIFY TODAY. I AM DAVE KENNEDY, ACTING CHIEF OF THE HAZARDOUS MATERIALS RESPONSE BRANCH, OFFICE OF MARINE ASSESSMENT, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA), U.S. DEPARTMENT OF COMMERCE. NOAA, AS THE ENVIRONMENTAL ARM OF THE DEPARTMENT OF COMMERCE HAS A GREAT DEAL TO CONTRIBUTE TO DISCUSSIONS ON THE STATE OF KNOWLEDGE OF OIL SPILL CLEANUP AND RESTORATION TECHNOLOGIES.

I WILL BEGIN BY PROVIDING AN OVERVIEW OF NOAA'S OIL SPILL FUNCTIONS. FOR NOAA, RESPONSE TO AN OIL SPILL REQUIRES THREE DISTINCT ACTIONS: RAPID RESPONSE FOR CLEAN-UP SUPPORT, DAMAGE ASSESSMENT, AND RESTORATION. A BRIEF EXPLANATION OF THESE THREE FUNCTIONS AND HOW WE HAVE ORGANIZED INTERNALLY TO CARRY OUT THESE ACTIVITIES WILL HELP YOU TO UNDERSTAND MY MORE GENERAL COMMENTS ON THE STATUS OF OIL SPILL RESPONSE AND RESEARCH.

THE HAZARDOUS MATERIALS RESPONSE BRANCH IS NOAA'S RAPID RESPONSE TEAM. THE BRANCH MAINTAINS NINE HIGHLY TRAINED SCIENTIFIC SUPPORT COORDINATORS (SSCS) WHO ARE LOCATED IN U.S. COAST GUARD DISTRICT OFFICES AROUND THE COUNTRY. THE SSC'S SERVE AS SCIENTIFIC ADVISERS TO THE FEDERAL ON-SCENE COORDINATOR (OSC) AND ARE BACKED BY AN INTERDISCIPLINARY GROUP OF CHEMISTS, ECOLOGISTS, METEOROLOGISTS, AND OCEANOGRAPHERS. THE BRANCH'S GOAL IS TO PROVIDE THE BEST AVAILABLE SCIENTIFIC INFORMATION IN A TIMELY FASHION TO ENHANCE THE EFFECTIVENESS OF RESPONSE OPERATIONS. SUCH SUPPORT REQUIRES THOROUGH PLANNING, FREQUENT TRAINING, AND CONTINUOUS EVALUATION OF NEW RESEARCH AND TECHNOLOGICAL IMPROVEMENTS TO ENSURE THAT ON-SCENE ADVICE IS RELEVANT, TIMELY, AND UP-TO-DATE. THE SSCS PROVIDE OIL SPILL TRAJECTORIES, IDENTIFICATION OF ENVIRONMENTALLY-SENSITIVE AREAS AND PRIORITY PROTECTION STRATEGIES, DATA MANAGEMENT AND DISSEMINATION, AND RECOMMENDATIONS ON ENVIRONMENTALLY PREFERRED CLEANUP ACTIONS. IN ADDITION TO SPILL PLANNING AND TRAINING BETWEEN SPILLS, BRANCH PERSONNEL PERFORM DEVELOPMENTAL WORK TO MAINTAIN STATE-OF-THE-ART CAPABILITIES TO SUPPORT THE OSC'S DURING SPILL RESPONSES. THE OSC/SSC RELATIONSHIP PROVIDES AN EXCELLENT EXAMPLE OF EFFECTIVE INTERAGENCY COOPERATION CALLED FOR IN THE OIL POLLUTION ACT. THIS WORKING RELATIONSHIP HAS BEEN IN PLACE FOR OVER A DECADE AND IS SOMETHING IN WHICH NOAA TAKES GREAT PRIDE.

ONCE A SPILL IS CONTAINED AND CLEAN-UP IS UNDERWAY, NOAA PUTS ON ITS OTHER HAT AS NATURAL RESOURCE TRUSTEE. UNDER THE PROPOSED EXECUTIVE ORDER IMPLEMENTING THE NEW OIL POLLUTION ACT OF 1990, NOAA WILL AGAIN BE NAMED AS TRUSTEE FOR THE NATION'S MARINE RESOURCES. THE ACT REQUIRES NOAA TO ASSESS THE INJURY TO THESE RESOURCES AND BRING AN ACTION FOR RECOVERY OF DAMAGES NECESSARY TO EFFECT COMPLETE RESTORATION OF THE INJURED RESOURCES. THE DAMAGE ASSESSMENT CENTER, ALSO LOCATED WITHIN THE NATIONAL OCEAN SERVICE, IS RESPONSIBLE FOR THE TECHNICAL ASSESSMENT OF ENVIRONMENTAL INJURY THAT IS RELATED TO AN OIL SPILL SO THAT APPROPRIATE COMPENSATION CAN BE RECOVERED FROM THE SPILLER FOR INJURIES TO NATURAL RESOURCES FOR WHICH NOAA IS A FEDERAL TRUSTEE. THE CENTER WORKS VERY CLOSELY WITH NOAA'S OFFICE OF GENERAL COUNSEL AND THE DEPARTMENT OF JUSTICE TO PROVIDE THE TECHNICAL SUPPORT REQUIRED FOR LITIGATION OR SETTLEMENT OF NOAA'S NATURAL RESOURCE DAMAGE CLAIMS. THE CENTER IS ALSO WORKING CLOSELY WITH THE GENERAL COUNSEL TO PREPARE NEW DAMAGE ASSESSMENT REGULATIONS THAT THE OIL POLLUTION ACT REQUIRES NOAA TO PROMULGATE.

BECAUSE THE ACT REQUIRES THAT MONIES RECOVERED FOR INJURIES TO NATURAL RESOURCES BE SPENT ON RESTORATION OF THOSE RESOURCES, NOAA HAS CREATED A RESTORATION CENTER, LOCATED WITH IN THE NATIONAL MARINE FISHERIES SERVICE, WHICH PROVIDES THE INSTITUTIONAL FOCUS FOR IDENTIFICATION AND EVALUATION OF RESTORATION METHODOLOGIES FOR SPECIFIC OIL SPILL CASES THAT CAN

BE IMPLEMENTED WITH RECOVERED MONIES FROM THE DAMAGE ASSESSMENT PROCESS. THE RESTORATION CENTER ALSO CONDUCTS BASIC AND APPLIED RESEARCH ON THE FUNCTIONAL VALUE OF ARTIFICIAL AND NATURAL RESOURCE HABITATS AND EVALUATE, METHODOLOGIES DESIGNED TO ENHANCE HABITAT OR RESOURCE RECOVERY AND DEVELOPMENT.

NOAA'S COASTAL OCEAN PROGRAM IS AN AGENCY-WIDE SCIENCE EFFORT THAT FOCUSES ON COASTAL ISSUES, AND INCLUDES SUPPORT OF RESEARCH AND ASSESSMENTS RELATED TO COASTAL HABITATS. THE ESTUARINE HABITAT AND TOXIC CHEMICAL CONTAMINATION PORTIONS OF THE COASTAL OCEAN PROGRAM SUPPORT NOAA AND UNIVERSITY STUDIES ON THE FUNCTIONING AND RESTORATION OF CRITICAL HABITATS.

OIL SPILL RESPONSE

I WOULD LIKE TO COMMENT UPON RESPONSE TECHNOLOGY AS SEEN FROM THE STANDPOINT OF OUR SCIENTIFIC ADVISORY ROLE. ALTHOUGH IT WAS LARGER THAN MOST SPILLS WE RESPOND TO, THE EXXON VALDEZ SPILL PROVIDES A GOOD PICTURE OF THE STATE OF RESPONSE AND CLEANUP CAPABILITIES IN THE U.S. THE NEWEST AND MOST SOPHISTICATED TECHNOLOGIES AVAILABLE, INCLUDING DISPERSANTS AND BIOREMEDIATION, WERE EVALUATED FOR USE DURING THE EXXON SPILL. DESPITE THAT FACT ALL OF OUR BEST TECHNOLOGY AND EFFORT WERE ONLY MARGINALLY SUCCESSFUL.

I WILL LEAVE MORE DETAILED DISCUSSION TO THE COAST GUARD REPRESENTATIVE AND WILL FOCUS MY REMARKS ON THE ENVIRONMENTAL CONSEQUENCES OF DIFFERENT CLEANUP TECHNOLOGIES.

DURING A SPILL, THERE IS A DELICATE BALANCE BETWEEN WHAT CLEANUP ACTIONS ARE FEASIBLE AND EFFECTIVE IN ACCELERATING RECOVERY AND WHAT ACTIONS WILL CAUSE MORE ENVIRONMENTAL HARM THAN BENEFIT. DURING THE EXXON VALDEZ SPILL, EXTREME PRESSURE WAS EXERTED ON EXXON AND THE COAST GUARD TO REMOVE ALL OIL FROM THE SHORELINE. HOT WATER UNDER HIGH PRESSURE WAS USED TO WASH THE HEAVILY-OILED SHORELINES IN ALASKA. AS SUMMARIZED IN YOUR LETTER OF INVITATION, THE RESULTS OF THIS STUDY SHOW THAT THOSE AREAS WHERE SUCH TECHNIQUES WERE USED ARE RECOVERING MUCH SLOWER THAN THOSE WHERE NO CLEANUP WAS CONDUCTED. FURTHERMORE, MUCH OF THE OIL REMOVED FROM THE SHORELINE WAS MIXED WITH SEDIMENT AND WASHED INTO THE PRODUCTIVE SUBTIDAL ZONE. THE SEDIMENT/OIL MIXTURE WAS HEAVIER THAN WATER AND SANK, THUS BEING UNAVAILABLE FOR RECOVERY. ALTHOUGH WE ONLY HAVE TWO YEARS OF DATA, THE RESULTS ARE REASONABLY CONCLUSIVE THAT PHYSICAL REMOVAL OF ALL OIL MAY NOT BE THE BEST APPROACH IN SOME ENVIRONMENTS. THIS EFFORT HAS BEEN SUPPORTED BY BOTH INDUSTRY--EXXON AND THE AMERICAN PETROLEUM INSTITUTE, AND THREE OTHER FEDERAL AGENCIES BESIDES NOAA--USCG, EPA, AND MMS. DATA FROM SUCH MONITORING OVER THE LONG TERM IS RARE. IT IS ONLY THROUGH THE DEVELOPMENT OF SUCH DOCUMENTATION

THAT WE CAN HOPE TO PERSUADE THE PUBLIC THAT THE OPTION OF NO-ACTION MAY IN SOME CASES BE BETTER FOR THE ENVIRONMENT THAN MAN'S INTERFERENCE.

ANOTHER OPTION CONSIDERED DURING THE EXXON VALDEZ RESPONSE WAS THE POSSIBILITY OF USING A "ROCK-WASHER" TO CLEAN THE CONTAMINATED BOULDERS ON CERTAIN ALASKAN BEACHES. AS PART OF ITS SSC FUNCTION, NOAA, IN CONSULTATION WITH OTHER AGENCIES AND SCIENTISTS, CONDUCTED AN ENVIRONMENTAL "COST-BENEFIT" ANALYSIS OF THE EFFICACY OF CLEANING THE BEACHES USING THIS METHOD AND CONCLUDED THAT THE ADVERSE EFFECTS WOULD FAR-OUTWEIGH THE BENEFIT OF REMOVING THE OIL. NOT ONLY WOULD THERE BE MAJOR DISTURBANCE TO THE SHORELINE FROM THE REMOVAL AND REINSTATEMENT OF THE COBBLES, BUT THE MOVEMENT OF PEOPLE AND EQUIPMENT WOULD LIKELY CAUSE MAJOR ENVIRONMENTAL DAMAGE AS WELL. ALTHOUGH EXXON HAD PREPARED AN ENGINEERING ANALYSIS OF THE EQUIPMENT REQUIREMENTS, THE EFFORT WAS STOPPED DUE TO THE ENVIRONMENTAL COST ENTAILED.

BOTH OF THESE EXAMPLES, THE HOT WATER CLEANING AND THE ROCK WASHING, HOWEVER, SHOULD SERVE TO DEFINE THE RUDIMENTARY NATURE OF OUR CLEANUP TECHNOLOGIES.

TWO NON-MECHANICAL TECHNOLOGIES HAVE RECEIVED A LOT OF PRESS ATTENTION LATELY AS POSSIBLE ALTERNATIVES -- DISPERSANTS AND

BIOREMEDIATION. I WOULD LIKE TO SPEND A FEW MINUTES DESCRIBING THE OPINIONS OF NOAA SCIENTISTS ON THESE TECHNOLOGIES.

THE APPLICATION OF DISPERSANTS, TO BE EFFECTIVE, MUST BE CONDUCTED WITHIN THE FIRST FEW HOURS OR DAY FOLLOWING A SPILL. THIS IS DUE TO THE PROPENSITY OF MANY OILS TO EMULSIFY, OR FORM A MOUSSE-LIKE SUBSTANCE, THAT CANNOT BE BROKEN DOWN BY A DISPERSANT AND SO BE DISPERSED INTO THE WATER COLUMN. IT REQUIRES PRE-APPROVAL OF DISPERSANT USE SO THAT EQUIPMENT AND DISPERSANTS CAN BE PRE-POSITIONED TO ALLOW THE NECESSARY RAPID APPLICATION. ALTHOUGH THE USE OF DISPERSANTS HAS BEEN CONDUCTED OVERSEAS FOR YEARS, THERE ARE VERY FEW INSTANCES OF APPLICATIONS IN U.S. WATERS. THIS IS DUE TO THE PERCEPTION OF THEIR EXTREME TOXICITY AND THE RETICENCE OF CAUSING THE OIL TO DISPERSE INTO OTHER PARTS OF THE MARINE ENVIRONMENT, THAT IS TO SAY THE WATER COLUMN. SINCE DISPERSANTS WERE FIRST USED IN GREAT QUANTITIES IN THE LATE SIXTIES WITH THE TORREY CANYON SPILL OFF THE BRITISH ISLES, DISPERSANTS HAVE BEEN DEVELOPED THAT ARE MUCH LESS TOXIC. NONETHELESS, THE QUESTION AS TO THE EFFICACY OF DISPERSING THE OIL INTO THE WATER COLUMN IN COMPARISON TO LEAVING IT AT THE WATER'S SURFACE WHERE IT CAN BE COLLECTED HAS NOT BEEN ANSWERED. EPA IS WORKING TO ANSWER SOME OF THE SCIENTIFIC QUESTIONS ASSOCIATED WITH DISPERSANT USE AS WELL AS DEVELOPING BETTER TESTING PROTOCOLS TO FACILITATE A MORE THOROUGH EVALUATION OF DISPERSANT POLICY IN THIS COUNTRY.

8

BIOREMEDIATION IS DEFINED TO INCLUDE THE USE OF NUTRIENTS TO ENHANCE THE ACTIVITY OF INDIGENOUS ORGANISMS AND/OR THE ADDITION OF NATURALLY OCCURRING NON-INDIGENOUS ORGANISMS. GENETICALLY ENGINEERED ORGANISMS ARE NOT CONSIDERED FOR USE AT THIS TIME. BIOREMEDIATION IS A NEW TECHNOLOGY FOR OIL SPILL RESPONSE THAT IS BEING EVALUATED, PRIMARILY BY THE EPA. DUE TO NOAA'S SSC FUNCTION, NOAA PERSONNEL HAVE BEEN INVOLVED TO SOME EXTENT IN MONITORING AND EVALUATING RESULTS FROM BIOREMEDIATION APPLICATIONS. BASED ON OUR OBSERVATIONS, DISCUSSIONS, AND EVALUATION OF DATA FROM BIOREMEDIATION STUDIES DURING THE EXXON VALDEZ, THE APEX BARGE SPILL IN GALVESTON, AND THE EXXON BAYWAY REFINERY PIPELINE SPILL IN 1990, WE FEEL THAT BIOREMEDIATION WILL PROBABLY HAVE MOST UTILITY AS A "POLISHING" TOOL, NOT AS A PRIMARY RESPONSE TOOL. DATA COLLECTED TO DATE ARE FROM LABORATORY SETTINGS WHERE CONDITIONS CAN BE CONTROLLED AND EFFECTS PRECISELY MEASURED. UNDER FIELD SITUATIONS, WE FEEL THAT DATA SHOWING THE EFFICACY OF BIOREMEDIATION AS A GENERAL CLEANUP TOOL ARE STILL INCONCLUSIVE, DUE IN PART TO THE DIFFICULTY OF ESTABLISHING VALID "CONTROLS" AGAINST WHICH TO MEASURE EFFECTS. BIOREMEDIATION HAS NOT BEEN SHOWN TO BE THE "SILVER BULLET" FOR OIL SPILL CLEANUP THAT SOME PEOPLE HAD HOPED. WE FIRMLY SUPPORT FURTHER RESEARCH TO DETERMINE THE MOST APPROPRIATE CONDITIONS WHERE BIOREMEDIATION MAY BE MOST USEFUL.

THE EXXON VALDEZ SPILL AND THE OIL POLLUTION ACT HAVE RE-FOCUSSED OUR ATTENTION ON THE NEED TO RE-EXAMINE OUR CAPABILITY TO RESPOND TO OIL SPILLS. TITLE VII OF THE ACT SPECIFICALLY HIGHLIGHTS THE NEED TO EXAMINE NEW TECHNOLOGIES AND APPROACHES THAT MAY IMPROVE OUR ABILITY TO MORE EFFECTIVELY RESPOND AND MITIGATE ADVERSE IMPACTS. NOAA ACTIVELY PARTICIPATES IN THE INTERAGENCY COMMITTEE WHICH THE COAST GUARD CHAIRS TO PREPARE A RESEARCH PLAN ON OIL SPILL RESEARCH AND DEVELOPMENT NEEDS AND PRIORITIES. WE FEEL THAT SUCH COORDINATION AND RE-EXAMINATION OF HIGH PRIORITY NEEDS IS LONG OVERDUE AND THAT THE INTERACTIONS RESULTING FROM THE PREPARATION OF THIS PLAN HAVE ALREADY FACILITATED SUCH COORDINATION. THE STATUS OF THIS PLANNING EFFORT WILL BE COVERED IN THE COAST GUARD'S TESTIMONY.

I WOULD LIKE TO TURN NOW TO DEVELOPMENTAL WORK THAT WE ARE PRESENTLY CONDUCTING TO SUPPORT SPILL RESPONSE. NOAA AND THE COAST GUARD ARE WORKING JOINTLY ON A DECISION SUPPORT SYSTEM THAT WILL COMBINE THE TECHNOLOGY OF PERSONAL COMPUTERS WITH THE EXPERIENCE THAT THE TWO AGENCIES HAVE GAINED OVER THE LAST TWO DECADES. THROUGH THE COMPILATION OF DATA ON SUCH TOPICS AS PHYSICAL PROPERTIES OF OILS, CLIMATOLOGY, OCEANOGRAPHY, AND EQUIPMENT SPECIFICATIONS AND INTEGRATION WITH MODELS THAT CAN PREDICT THE CHARACTERISTICS OF OIL AND ITS TRAJECTORY, WE HOPE TO BE ABLE TO BRING ON-SCENE A MORE TIMELY AND EFFECTIVE RESPONSE CAPABILITY. THIS CAPABILITY WILL ALLOW THE OSC TO DETERMINE, FOR INSTANCE, WHETHER CERTAIN EQUIPMENT WILL BE EFFECTIVE WITH

CERTAIN OILS, SINCE THE COMPUTER WILL BE ABLE TO PREDICT THE OIL CHARACTERISTICS OVER TIME AND COMPARE THAT DATA WITH THE SPECIFICATIONS OF DIFFERENT TYPES OF EQUIPMENT. WE ALSO HOPE TO INCLUDE INFORMATION ON PAST EXPERIENCES, SUCH AS THOSE FROM THE EXXON VALDEZ CLEANUP, THAT WILL HIGHLIGHT THOSE ACTIVITIES THAT AGGRAVATED ENVIRONMENTAL IMPACTS OR FACILITATED ENVIRONMENTAL RECOVERY SO THAT MISTAKES WILL NOT BE REPEATED AND THAT POSITIVE ACTIONS WILL BE USED INSTEAD. THROUGH A JOINT NOAA-EPA PROGRAM, CALLED THE COMPUTER AIDED MANAGEMENT OF EMERGENCY OPERATIONS (CAMEO), WE HAVE BROUGHT ONSCENE THE CAPABILITY TO RAPIDLY MANAGE LARGE AMOUNTS OF INFORMATION REQUIRED BY RESPONSE PERSONNEL TO CHEMICAL ACCIDENTS. THROUGH THIS JOINT EFFORT WITH COAST GUARD, WE HOPE TO CREATE THE SAME CAPABILITY FOR OIL SPILL RESPONDERS.

RESTORATION OF OIL-IMPACTED ENVIRONMENTS

AS MENTIONED EARLIER, RESTORATION ACTIVITIES ARE FOCUSSED IN THE NATIONAL MARINE FISHERIES SERVICE WHERE THE MAJORITY OF NOAA'S LIVING MARINE RESOURCE RESPONSIBILITIES AND EXPERTISE RESIDES. HABITAT LOSS AND DEGRADATION CONTINUES TO BE ONE OF THE MOST SERIOUS ENVIRONMENTAL RISKS FACING OUR COUNTRY TODAY. OIL SPILLS ARE JUST ONE OF MANY HUMAN ACTIVITIES THAT CAUSE DEGRADATION OF THE COASTAL AND MARINE ENVIRONMENT. AS CONCERN FOR THESE ADVERSE EFFECTS INCREASES, WE ARE LOOKING MORE AND MORE TO RESTORATION AS A SOLUTION. RECOVERIES FROM OIL SPILL LITIGATION AND SETTLEMENTS MUST BE USED FOR RESTORATION,

REPLACEMENT, OR ACQUISITION OF THE EQUIVALENT OF THE INJURED RESOURCES. IT IS CRITICAL THAT OUR CAPABILITIES FOR RESTORATION BE EFFECTIVE.

REVIEW OF THE EXTREMELY LIMITED LITERATURE AVAILABLE INDICATES THAT ALTHOUGH MANY TECHNIQUES EXIST TO CREATE AND RESTORE COASTAL HABITATS, THE GENERAL PROCESS OF HABITAT RESTORATION AND MITIGATION HAS NOT BEEN VERY SUCCESSFUL. WHILE THERE HAVE BEEN SOME SUCCESSES, RESTORATION HAS NOT EVEN BEEN TESTED FOR MOST WETLAND TYPES. FURTHERMORE, THERE IS NO LONG-TERM FOLLOW-UP ASSESSMENT OF THE CONTRIBUTION OF CREATED AND RESTORED AREAS TO AN ECOSYSTEM. COMPLIANCE AND ENFORCEMENT OF MITIGATION REQUIREMENTS HAS A POOR TRACK RECORD. THE FEW STUDIES IN WHICH MAN-MADE WETLANDS HAVE BEEN MONITORED OVER TIME TO DETERMINE THEIR FUNCTIONAL VALUE SUGGEST THAT THESE WETLANDS ARE POOR SUBSTITUTES FOR NATURAL WETLANDS.

RESEARCH IS NEEDED TO DEVELOP RESTORATION TECHNOLOGIES, CRITERIA TO GUIDE ALL RESTORATION EFFORTS AND CRITERIA TO JUDGE THE SUCCESS OF RESTORATION ACTIONS. NOAA'S COASTAL OCEAN PROGRAM AND THE DAMAGE ASSESSMENT AND RESTORATION CENTER ARE ADDRESSING SOME OF THESE RESEARCH NEEDS.

THIS LACK OF KNOWLEDGE OF SUCCESSFUL RESTORATION PRACTICES, HOWEVER, EXTENDS FAR BEYOND RESTORATION FROM OIL SPILL EFFECTS. CONSEQUENTLY, THE RESTORATION CENTER IS PURSUING JOINT RESEARCH

WITH OTHER AGENCIES, SUCH AS THE ARMY CORPS OF ENGINEERS, WHO ARE INVOLVED WITH OTHER HUMAN ACTIVITIES THAT MAY ADVERSELY IMPACT THE COASTAL ENVIRONMENT, WITH THE EXPECTATION THAT SOME KNOWLEDGE WILL BE TRANSFERRABLE TO THE RESTORATION OF OIL-IMPACTED ENVIRONMENTS. AS IS APPARENT, WE HAVE A LONG WAY TO GO TO FEEL CONFIDENT IN OUR ABILITY TO SUCCESSFULLY RESTORE AN INJURED ENVIRONMENT. WE HOPE THAT IN THE NEAR FUTURE, AS COMPENSATION FOR OIL SPILL DAMAGES BECOMES AVAILABLE, WE WILL BE ABLE TO DEVELOP A MUCH BETTER TRACK RECORD OF RESTORING OIL-IMPACTED ENVIRONMENTS. IN ADDITION, NOAA'S COASTAL OCEAN PROGRAM CURRENTLY SUPPORTS A NUMBER OF STUDIES, BOTH WITHIN NOAA AND WITHIN THE UNIVERSITY COMMUNITY, TO UNDERSTAND HABITAT FUNCTION AND TO DEVELOP TECHNIQUES FOR RESTORING AND ASSESSING DAMAGED OR LOST HABITAT.

I HOPE THAT THESE BRIEF REMARKS HAVE PROVIDED SOME INSIGHT INTO THE STATE OF CLEANUP AND RESTORATION TECHNOLOGIES. I WOULD WELCOME ANY QUESTIONS THAT THE MEMBERS MAY HAVE.

TESTIMONY OF
ALFRED W. LINDSEY
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AND TECHNOLOGY DEMONSTRATION
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON OCEANOGRAPHY, GREAT LAKES
AND THE OUTER CONTINENTAL SHELF
AND THE
SUBCOMMITTEE ON COAST GUARD AND NAVIGATION
OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES
U.S. HOUSE OF REPRESENTATIVES

JUNE 18, 1991

Good morning. I am Alfred W. Lindsey, Director of EPA's Office of Environmen-
ıl Engineering and Technology Demonstration. I appreciate the opportunity to meet
ith you this morning to discuss EPA's research and development efforts for
ıproving existing technologies for cleaning up oil spills.

Through the National Response Team, the EPA works closely with the Coast
uard and other Federal and State agencies in all spill response activities. In addition,
esident Bush designated EPA as the federal restoration coordinator for the Exxon
ildez oil spill. The EPA issues Federal regulations regarding oil spills under the Oil
ollution Act of 1990. We implement spill prevention regulations for non-transporta-
on related facilities. Through subpart J of the National Contingency Plan (NCP), EPA
egulates the use of dispersants and other chemicals for mitigating the effects of oil
pills. EPA also provides On-Scene Coordinators for inland spills. The Agency's
mergency Response Team (ERT) is a group of highly trained scientists and engineers

whose capabilities include multimedia sampling and analysis, hazard evaluation, cleanup techniques and overall technical support to the on-scene coordinators.

EPA has a history of successful research and development activities in oil spill remediation. This work has led to numerous devices suitable for containing and/or removing oil from the surface of the water, determination of the toxicity of dispersants and oil, development of oil/water separation devices, and research to determine the fate and effects of oil following a spill.

In 1989, after the Exxon Valdez incident, the EPA quickly undertook a major field and laboratory effort to determine the efficacy of utilizing bioremediation techniques to mitigate the oil which reached the beaches of Prince William Sound. The results from EPA's Alaska oil spill bioremediation project showed that the presence of oil on the beaches of Prince William Sound, Alaska, caused a significant enrichment of oil-degrading microorganisms in the beach material, but their effectiveness in degrading the oil was limited by the availability of nitrogen and phosphorus nutrients. Our field study program has demonstrated convincingly that fertilizers can be applied to oiled beaches to overcome these nutrient limitations, thereby enhancing biodegradation of the oil.

EPA's approach was to apply commercially available fertilizers to test plots on oiled beaches. Both soluble and oleophilic (attracted to oil) fertilizers were applied. Within weeks, the test plots were visually cleaner and scientific analysis confirmed

that the rates of oil degradation were significantly enhanced. Additionally, bioremediation of oil-contaminated beaches was shown to be a remediation technology with no adverse environmental effects The fertilizers caused no eutrophication, were not acutely toxic to sensitive marine test species , and did not cause the release of undegraded oil residues from the beaches.

Based on EPA's experimental success, Exxon used the technique on 75 miles of beach with similar visual and scientific results. The success of our field demonstration program has now set the stage for the consideration of bioremediation as a key component (but probably not the sole component) in any cleanup strategy developed for future oil spills. Its use is also promising as a restoration technology after cleanup has taken place. Its use and effectiveness will depend on the amount of oil present in the contaminated environment matrix; that is, a longer time will be required for degradation of high concentrations of oil and consequently a longer period of fertilizer application also will be required. In addition, location of the oil and the acceptability of other cleanup options must be considered.

Shortly after the Alaskan oil spill, the various Federal and State agencies overseeing the cleanup efforts received a large number of proposals from bioremediation product vendors throughout the world offering to help reduce the effects of the spill by enhancing the biological degradation of the oil. Producers of microbial and other types of oil spill products wanted the opportunity to prove the value of their

products under the conditions in Alaska. However, there was no mechanism in place at that time to objectively evaluate the products.

To further accelerate the development of this technology, EPA sponsored the Bioremediation Action Committee (BAC) on the recommendation of participants at the February 1990 EPA-Industry Meeting on Environmental Applications of Biotechnology. The purpose of the BAC is to provide a forum of government, academic and industry experts to facilitate the advancement of the science as well as the industrial application of bioremediation. The actual work of the BAC is accomplished through its six subcommittees. These are Treatability Protocol Development, National Bioremediation Spill Response, Data Identification and Collection, Research Needs, Education Needs, and Pollution Prevention.

Building on the initial work in Alaska, the Treatability Protocol Development Subcommittee, with National Environmental Technology Applications Corporation (NETAC) and EPA, have been developing a series of laboratory and field testing protocols that can be used to objectively screen bioremediation products for efficacy and toxicity. Initial focus has been on protocols for application of bioremediation products in cobble beach and open water scenarios, with the following other scenarios to follow.

- Marsh and Wetlands
- Inland Shorelines
- Sandy Beaches

- o Special areas, i.e., Mangrove forests
- o Land and soil

Thus, by the end of 1991, a family of testing protocols will be available to conduct performance evaluations of bioremediation products. Tests run against these protocols could then become the primary basis for a product to be listed in the NCP. EPA's intent is to establish an information database to enable rapid access to product information and suppliers, results of protocol tests, and identification of products that could be matched to specific spill scenarios and conditions. This information will immediately be made available to decision-makers in real spill situations.

In other work, the BAC Bioremediation Spill Response Subcommittee has developed interim guidance on preparing bioremediation spill response plans. This guidance should be of immediate use to on-scene spill coordinators and State response officials. In a joint effort, the BAC, State of Texas and the Region VI Response Team are developing a pilot response plan focusing on Galveston Bay.

The research effort conducted in Alaska and the follow-on broader effort on the use of bioremediation for cleaning up oil following a spill is a major part of EPA's program under the coordinated Interagency Oil Spills Research & Development effort chaired by the Coast Guard under Title VII of the Oil Pollution Act of 1990. Based on our prior efforts and on the expertise of our scientists and engineers, EPA is focusing its research program on the following areas:

1. Bioremediation technology assessment
2. Dispersant efficacy and toxicity assessment
3. Technology development for inland spill containment and removal
4. Cleanup debris disposal

Initial emphasis is being placed in the bioremediation area since the ongoing program shows real promise for further success. In the future we will undertake a similar effort to develop efficiency and toxicity data for the use of various dispersants. Protocols similar to those being developed for bioremediation products, are envisioned for dispersants as well.

While containment and removal techniques used on marine spills usually are applicable on inland spills, fast moving and shallow turbulent streams pose a unique challenge for removal technology. Currently no satisfactory technology is available to deal with oil containment and removal under these conditions. Therefore, the Agency will continue research in this area.

Oily debris generated during the cleanup of spills includes a wide variety of materials used during the cleanup operations, e.g., sorbents, as well as naturally occurring materials which have been coated with oil. Lack of information on the environmental adequacy and cost effectiveness of alternative treatment and disposal options is a major hinderance to efficient and effective cleanup operations. EPA

intends to evaluate promising alternatives and develop an information base available to spill decisionmakers.

In conclusion, I would like to say that the development of the Interagency R & D plan has brought the federal community involved with oil spills closer together. In a very real sense agencies have been able to focus on the priority areas where they can make an impact while leaving other R&D efforts to others. In other areas cooperative activities are emerging that allow the talents of several agencies to be brought to bear on a problem in a significant way. I think that this cooperative spirit will allow us to develop the tools necessary to minimize the risk of damage from future spills and to provide improved cleanup and restoration technologies in the event of another major spill.

Thank you again for the opportunity to speak before the Subcommittees. I will be glad to respond to any questions you may have.

Testimony
of
Edward Tennyson
Program Manager for Oil Spill Response
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U.S. Department of the Interior

Before the
Subcommittee on Oceanography, Great Lakes
and Outer Continental Shelf
and
Subcommittee on Coast Guard and Navigation
Merchant Marine and Fisheries Committee

U.S. House of Representatives
Washington, D.C.

June 18, 1991

Mr. Chairman, I appreciate the opportunity to testify on the current state-of-the-art for oil spill response in the open ocean and the technology assessment and research program on oil spill cleanup being conducted by the Minerals Management Service (MMS) of the United States Department of the Interior.

As you are aware, MMS administers the nation's Outer Continental Shelf (OCS) oil and gas program. In that capacity, we have supported oil spill technology research and development for 14 years. During this period, MMS, and its predecessor office in the U.S. Geological Survey (USGS), Conservation Division, has maintained a formal program conducting applied research on the technology needed to support safe and clean OCS activities. These activities include: permitting and regulating offshore oil and gas operations; reviewing and approving industry exploration, development and production, and oil spill contingency plans; conducting OCS facility accident investigations; inspecting and taking enforcement actions; and prescribing well-control training for industry personnel. Strong technological support also is required for activities such as reviewing and verifying the integrity of OCS structures and pipelines, preventing oil well blowouts, and preventing and mitigating water and air pollution.

In 1979, the USGS joined the U.S. Coast Guard, the U.S. Navy, the Environmental Protection Agency (EPA), and the Canadian Department of the Environment (Environment Canada), in an interagency and international oil spill response evaluation program run primarily at the Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) facility in Leonardo, New Jersey. OHMSETT provides a very large open tank facility capable of generating waves, testing cleanup techniques, and burning oil on water and in floating ice conditions. Since 1979, USGS

(and later MMS) has spent as much as $1.2 million per year evaluating and improving spill response equipment and procedures.

Since 1986, MMS has invested approximately $250,000 per year on research designed to improve oil spill response technologies and procedures. In 1986, MMS and Environment Canada executed a Memorandum of Understanding and began a fruitful joint research program. This program was established, in part, as a consequence of the closing of the OHMSETT facility by EPA and the cessation of oil spill response studies by the other agencies. It should be noted that in April 1990 MMS finalized an agreement with the Navy to re-open and assume full use of the OHMSETT facility. The facility is scheduled to be reactivated during 1991. MMS chairs the OHMSETT Interagency Technical Committee that manages operations at the facility.

The program with Environment Canada has been mutually advantageous because of the shared concerns for oil spill mitigation and the complementary scientific work undertaken by each agency. This working relationship greatly broadened the MMS program and furthered its research efforts by providing the funding, ships, aircraft, and technical support for conducting two at-sea experiments on the standardization of procedures for evaluating containment booms and the effective use of chemical treating agents. This combined program has:

- Developed the capability of using shipboard navigational radar to detect and track open ocean oil spills;
- Developed and verified a nonpolluting and cost effective test procedure to evaluate the performance of offshore oil spill containment booms;
- Initiated a program to evaluate the capabilities for burning spilled oil in-place in broken ice fields;
- Initiated a program to quantify and model the behavior and fate of burn products from in-place burning of spilled oil;
- Developed the technique of containing oil by sweeping downwind when rough weather conditions preclude effective operations in the normal upwind mode;
- Evaluated innovative containment and collection techniques for broken ice conditions;
- Performed engineering and cost studies based on the use of converted tankers to tow containment booms on each side and to suspend subsea collection devices over blowing wellheads. The tankers could store the oil, separate the water from it, and remain at sea for extended periods;
- Evaluated the capabilities of two oil spill chemical additives to significantly improve the recovery capabilities of existing equipment;

- Conducted research and engineering design of airborne laser ignition systems to ignite spilled oil in the open ocean;

- Evaluated and optimized the design of a high pressure water jet barrier for containing oil in high current areas and in broken ice conditions;

- Initiated investigations into the behavior of heavy oils, such as some of those on the California OCS. These oils tend to sink below the ocean surface but wash up in the surf zone contaminating beaches; and

- Initiated investigations into improved airborne remote sensing of oil spills to determine the thickness and extensiveness of slicks.

MMS also has cooperated in the exchange of technological information with Japan, Norway, the United Kingdom and France, through informal contacts, workshops, and technical meetings, such as the biennial Oil Spill Conference.

Consistent with its policy of conducting broad synthesis meetings on topics of concern, MMS arranged with the National Institute of Standards and Technology (NIST) (formerly the Bureau of Standards) to conduct a technical workshop in Alaska in November 1988, to present the state-of-the-art, recent research results, and to seek consensus on future research needs for oil spill responses in cold and seasonally ice-covered waters. Recognized experts submitted papers and served as session chairmen. Many of the research areas discussed at the workshop were already being addressed by the MMS research program; others will be considered in future studies. Clear opportunities for cooperative support for additional research are identified in the proceedings.

Additionally, MMS conducts research on oil spill risk analysis; reduction of hydrocarbon emissions from OCS facilities; improved blowout prevention; and the physical forces that act on oil and gas facilities in deeper waters, areas of ice and earthquake activity, high currents, and periodic extreme weather conditions.

The MMS research program brings together expertise through cooperative research arrangements and contracts in all areas of oil spill response. Environment Canada is recognized for its expertise in chemical treating agents and detection. The National Institute of Standards and Technology, our U.S. research partner, possesses expertise on in-situ burning. MMS itself maintains recognized expertise in detection, mechanical containment and recovery of spilled oil, and oil spill preparedness.

USGS (and later MMS) funding for oil spill response technology investigations and for evaluating equipment and procedures totaled $3.2 million between 1979 and 1989. This sum has been substantially leveraged since 1986 because Environment Canada, in effect, has matched MMS funding.

To our knowledge, from 1987 to 1990, MMS and Environment Canada have been the only government agencies in North America conducting significant oil spill research and technology development programs. We believe that significant gains have been made in detecting spills, quantifying and improving the performance of open-ocean response equipment, developing new chemical treating agents, and developing the capability to burn spilled oil on the surface of the ocean.

Subsequent to major oil spills in 1989 from various tankers accidents, the MMS accelerated its research program to approximately $1.2 million. Contributions from Environment Canada, the American Petroleum Institute (API), the U.S. Coast Guard and both the domestic and foreign private sector have raised the total funding for the MMS initiated program to just over $4.8 million per year for Fiscal Years 1990 and 1991. In the President's FY 1992 budget, a substantial increase over FY 1991 funding has been proposed. This increase will be used to replace API's contribution of $1 million per year since their funding will terminate at the end of 1991.

In FY 1992, MMS plans to continue work on development and testing of remote oil slick detection and analysis instrumentation; at-sea verification of chemical treating agents and slick burning; the development of strategies for shore line cleanup; and the operation of the nearly refurbished OHMSETT facility.

A Review of the State-of-the-Art in Oil Spill Response Technology

A number of factors have to be considered in the evaluation of the adequacy of spill response. These include sea state, expected weather, type of oil, size of spill, elapsed time from spill to response, presence of ice, and level of response effectiveness. Readiness includes the siting of sufficient equipment and trained personnel to address spill response issues. A major aspect of preparedness is the state-of-the-art of existing equipment and procedures, including capabilities for detection, containment, recovery, disposal, alternative responses, e.g., chemical treating agents and in-situ burning.

The state of knowledge in the field and the potential for short-term practical gains are as follows:

a. **Detection:** Practical oil spill detection is still by visual observation which is limited to favorable sea and atmospheric conditions and is inoperable in rain, fog, or darkness. Airborne remote sensing packages have been developed using side-looking radar, infrared and ultraviolet/false color cameras. These systems are not resources usually available to responders. Presently, MMS research has devised a method of specially tuning shipboard navigational radar to track oil spills in all but extremely rough sea conditions. This technique has been used successfully on three successive oil spills. However, before it can become a reliable operational tool, additional research is necessary to correlate slick characteristics, i.e., slick thickness and sea state with the radar presentation.

Presently, airborne remote sensing packages cannot discriminate between areas of a slick which are thick enough to recover and portions too thin for any reasonable response effort. The MMS and Environment Canada have initiated research on the measurement of thickness from aircraft so that response teams can direct collection efforts to areas which permit meaningful recovery.

Detection capability of oil in ice conditions commonly associated with the Bering, Chukchi, and Beaufort Seas is also being investigated. The joint MMS/Environment Canada program is evaluating technologies and has identified a laser-fluor sensor which can detect oil in broken ice.

An improved understanding is needed by spill response teams to project the transport of oil on the surface as it is driven by winds and currents. In this respect, oil spill trajectory models have been developed and drifting buoys, tracked by satellites, are being evaluated to determine their ability to follow a spill.

During several recent spills, oil has submerged and reappeared in surf zones and on beaches. We believe that fish-finding sonar can be used to successfully track submerged oil so that effective countermeasures can be implemented before the oil washes ashore. This and other techniques for tracking subsurface oil are planned for evaluation.

b. **Containment**: Capabilities for using open ocean booms to contain oil are unquantified in waves over 2 to 3 feet. Yet these waves are often exceeded on the OCS. Conventional knowledge indicates that containment booms will not effectively operate in wind speeds over 15 to 20 knots or at tow speeds exceeding 1/2 to 3/4 knots. During recent MMS/Environment Canada experimental oil spill operations, conducted off St. John's, Newfoundland, oil was successfully contained by booms towed with the wind, instead of against it, in contravention of conventional practice. This new technique resulted in successful containment in winds up to 35 knots and at tow speeds up to 1.4 knots. Further evaluation of experimental spills or spills-of-opportunity is required for operational acceptance.

Currently, there are more than 30 different designs of booms in use in the OCS. The relative capabilities of these booms have not been properly quantified for lack of a standardized testing technique or protocol. The MMS together with Environment Canada, U.S. Coast Guard, and EPA has initiated the development of an extensive test protocol that would rate the performance of containment booms without requiring the intentional spillage of tens of thousands of gallons of oil as is the current international practice. This protocol was evaluated and conditionally verified off Newfoundland in 1987; however, further analysis and tests are necessary. When completed, standard nonpolluting test procedures can be devised to evaluate the performance of each containment boom in a wide range of sea states.

c. **Recovery**: Several offshore skimmers of differing oil retrieval concepts have been evaluated at OHMSETT and elsewhere in realistic offshore conditions. Additional testing would be of minimal value. New and innovative designs for operations in ice should be evaluated and improved. A joint MMS/Environment Canada research project to evaluate a barrier/skimmer designed for ice operations is currently underway.

An evaluation of beachline cleanup procedures is scheduled in order to develop effective procedures which do not adversely affect beach types which occur in Alaska, British Columbia, Washington, Oregon, and central and northern California.

d. **Disposal**: Enhancement of existing disposal techniques is required to eliminate large volumes of recovered fluids normally associated with a major spill (exceeding 100 barrels of oil). Disposal includes storage onscene, transportation to an acceptable disposal site, and ultimate disposal techniques. Incineration is a field of investigation which should be accelerated beyond current project levels. Disposal techniques in cold regions will also require further research.

e. **Chemical agents**: These comprise broad categories of dispersants and nondispersants. Dispersants should enhance the breakup of oil slicks into droplets small enough to be acted upon by microbial action. Dispersants routinely have not worked well offshore and recent MMS/Environment Canada research indicates that effectiveness can be significantly increased by reformulation of existing dispersants. This research is progressing.

The MMS and Environment Canada have identified several chemicals which inhibit the formation of emulsions, retard slick spreading, and change the physical properties of spilled oil to enhance its burnability or recoverability, thus, significantly increasing recovery rates with existing equipment. This research is continuing to identify other chemical additives.

f. **In-situ burning**: A major advance in spill response has resulted from joint MMS/Environment Canada research begun in 1983 under which the limiting conditions for burning oil on the surface of the open ocean have been studied. Prudhoe Bay, Amuligak, and several other oils were evaluated to determine the effects of several physical variables (slick thickness, weathering, sea state, wind, temperature, degree of emulsification, and degree of ice coverage) on the percent of the oil which could be removed from the water column. All of the oils tested burned with 50-90 percent plus removal ratios as long as emulsification had not occurred. This phase of the research is completed. Burning offers the greatest potential gain for combating major oil spills or for mitigating spills in remote areas. Of utmost concern is the effect on air quality of major oil burns. A joint MMS/Environment Canada research effort was begun in 1985 to quantify burn products and to model the behavior of the products as a function of time and cooling. This research utilizes a Department of Defense "Nuclear Winter" computer model which addresses the behavior of smoke plumes from numerous fires in discrete areas.

Another aspect of the combined MMS/Environment Canada research program is to investigate the behavior of nontypical crude oils and refined products. Unlike most domestically produced crudes which rapidly dissipate under natural conditions, these oils, including North Slope crudes, rapidly form emulsions or surface skins or sink over relatively short periods. They persist as a result of their unusual behavior. Understanding the behavior of these types of oils is crucial in developing improved response strategies.

Conclusion

In administering the nation's offshore program, MMS is committed to managing those resources in an environmentally sensitive manner. To that end we are also committed to minimizing any potential adverse environmental impacts from offshore oil related activities. Therefore, we will continue to place a high priority on oil spill research and are pleased that additional funding has been made available for that purpose under the Oil Pollution Act.

That concludes my prepared statement. I would be happy to respond to any questions that you or Members of the Subcommittee may have.

Marine Spill Response Corporation (MSRC)

Statement of Alan Breed

Vice President, Operations and General Manager

before a

Joint Hearing

of the

Coast Guard and Navigation Subcommittee

and

Oceanography, Great Lakes and Outer Continental Shelf Subcommittee

Mr. Chairman, I appreciate the opportunity to provide you and both Subcommittees with information on the operational concept and capabilities of the Marine Spill Response Corporation.

BACKGROUND

Two years ago, on a reef in Alaska's Prince William Sound, the oil tanker Exxon Valdez ran aground causing America's biggest oil spill. While thousands worked to clean up the spill in Alaska, a task force in Washington, representing America's oil industry set about studying the existing resources across the nation for responding to catastrophic oil spills.

In June of 1989 the task force reported its findings: The capability did not exist, neither in industry nor government, to successfully contain and remove a spill the magnitude of the one in Alaska.

As a result of task force recommendations, twenty oil companies began the process of creating a privately financed capability to manage catastrophic spills. In August 1990, this culminated in the formal establishment of two new organizations: The Marine Spill Response Corporation (MSRC) and the Marine Preservation Association (MPA). Both MPA and MSRC are not-for-profit companies. MSRC is the response organization. MPA is the funding organization.

When operational, MSRC will have five regional response centers, supported by 22 strategically placed equipment sites along the continental U.S. coast and in Hawaii and the Virgin Islands. It will become the nation's largest spill response and cleanup organization. Our present plans call for an expenditure of over $800 million over the next five years.

MPA is an organization comprised of oil companies, the shippers and receivers of oil. MPA will be funding grants to MSRC but have no control over day-to-day operations.

MSRC is headquartered in Washington, D.C. Our five Regional Response Centers are located along the coastal United States in the New York/ New Jersey area in the Northeast, the Miami area in the Southeast, in Lake Charles, Louisiana in the Gulf, Port Hueneme, California in the Southwest, and the Seattle, Washington area in the Northwest. Each region will have three to six prestaging sites where equipment, supplies and sometimes vessels, personnel and barges will be located. Each site has been selected to enhance a rapid response to a large spill in areas of significant maritime oil traffic and lightering areas. Operationally, the nearest equipment/resources will be the first brought to the scene of a spill. Depending upon the size of a spill, resources may be drawn from two or more regions.

RESPONSE

MSRC, under the direction of the Coast Guard, will provide a "best-effort" response to cleaning up oil spills that are beyond the capacity of local response organizations. MSRC's regional response capabilities are being designed based on a 30,000 ton spill, which is approximately the size of the Prince William Sound spill.

MSRC's principal focus is on major open ocean spills. Much, but not all, of the equipment being acquired may also be used in shallower, more protected waters, if necessary. Shallow water capabilities may be particularly important in the gulf region and along the southern coast of the U.S.

Because of many uncontrollables in a spill, like the weather, MSRC can only promise a "best effort" response in all areas specified in its charter. Those areas include coastal waters up to 200 miles to seaward, Hawaii, Puerto Rico and the American Virgin Islands. In addition, MSRC will provide response service in many inland tidal areas, except the Great Lakes, and those rivers traversed by tankers to/from upriver facilities on voyages in/out bound from sea.

As previously stated, MSRC is being organized to provide a rapid response to spills, and our assets are planned along the U.S. coastline so that response times will be as short as practicable. Moreover, we are procuring equipment that is highly transportable. All of MSRC's sites, both for response centers and vessels, as well as warehouse sites have been selected on the basis of access to the water, interstate highway and airport transportation systems.

The specific locations of sites are based upon our estimates of where the potential for accidents are greatest. MSRC's equipment positioning thus follows petroleum movement patterns, especially the movements of persistent oil. For planning and design purposes (and not as any promise of performance in any particular spill), MSRC's target is to be on scene in coastal and harbor areas of highest probability of a spill within about 14 hours after notification of the spill, weather permitting. Assuming favorable weather conditions, this generally equates to a radius of response of approximately 140 miles from the locations of response units. MSRC will respond to spills at greater distances, but the on-scene time of those responses necessarily will not be as quick as from that in the principal areas of focus. Because of the uncertainties of weather and spill location, MSRC can only offer that it will use its best efforts in its responses. Our current planning factor is to have people and resources moving out to respond to a spill within two hours of notification. Arrival times of resources on scene cannot be guaranteed due to varied locations and unpredictable weather and sea conditions.

Two major uncertainties with respect to our level of response are:

- How federal authorities will define removal of a worst case discharge,"to the maximum extent practicable"
- Whether and to what extent the techniques of cascading MSRC equipment from other regions will satisfy federal and state response plan requirements.

RESPONSE SERVICES

MSRC is planning to provide many, but not all, emergency spill response and cleanup services. These are listed below.

- Containment
- Removal including mechanical and dispersant options
- Shoreline Protection
- Disposal Information/Oily recovered material disposal support
- Beach/Shoreline Cleanup
- Wildlife Rehabilitation Support
- Onsite Communications

MSRC is principally an on the water containment and removal organization. Thus, after the emergency phase of a spill, MSRC intends to hand off long-term shoreline remediation to others. Currently, the MSRC budget/plans do not include resources for bioremediation or in-situ burning and some other non-mechanical removal techniques. MSRC plans to do Research & Development in these areas. If any/all of these methods become acceptable techniques to cognizant approving authorities, MSRC intends to request funds to add them to the services it will provide.

MSRC expects to have a towing capability only to meet MSRC barge movement needs. If this capability can be used to mitigate/stabilize a spill situation it could be made available until other

towing vessels arrive onscene. MSRC expects to own portable pumping equipment and barges which could be used in lightering operations but MSRC will not offer lightering services. However, this equipment could be put at the disposal of a separate lightering contractor. MSRC response vessels may also be equipped with fire monitors. If so equipped, MSRC vessels would not offer firefighting services except as a "first on scene" emergency responder or as a supplement to a separate firefighting contractor, if required. MSRC does not plan to be capable of providing salvage services. MSRC will have beach/shoreline cleanup capability but will not offer shoreline restoration services. At an appropriate time in the cleanup this work would be assumed by other contractors.

EQUIPMENT

MSRC equipment will be positioned to provide a high response capability in the most likely locations of a major oil spill. We plan to locate our offshore response vessels as follows:

- Portland, Maine
- New York/New Jersey Harbor Area
- Delaware Bay
- Lower Chesapeake Bay
- Savannah, Georgia
- Miami, Florida
- Mobile, Alabama
- Venice, Louisiana
- Lake Charles, Louisiana
- Galveston, Texas
- Port Hueneme, California
- Astoria, Oregon
- Seattle, Washington Area

- Oahu, Hawaii
- St. Croix, American Virgin Islands

A tentative list of equipment planned for each site is attached as enclosure (1).

ROLE WITH GOVERNMENT/INDUSTRY AND IMPLEMENTATION

Although MSRC is a private organization that will work closely under contract with a spiller to execute portions of the spiller's response plan, it will also work closely with governments. Under the Oil Pollution Act, spillers must respond under the direction of the Coast Guard during major spills in coastal areas. The presence of the Coast Guard at a spill site does not relieve spillers of their responsibilities for funding the clean up. The Coast Guard must, however, provide clear direction and coordination of cleanup operations when spills or potential spills pose a substantial threat to the public health and safety.

MSRC is not intended to replace existing oil spill cooperatives and independent response contractors. In fact, MSRC will subcontract with co-ops and independent responders for major spills and will train and drill with them. These existing entities have done a good job handling smaller spills. MSRC will only act when this infrastructure does not have sufficient resources for larger spills. Importantly, the Coast Guard, not MSRC will make this determination.

IMPLEMENTATION

MSRC is working hard to be fully operational by February of 1993--the date when the Oil Pollution Act requires owners and operators of vessels, terminals, pipelines and offshore platforms to submit comprehensive spill response plans. Although much has been accomplished, much remains to be done in the intervening 20 months.

A detailed implementation plan has been developed, with most of the work still underway. Equipment and vessels are being procured. Regional Response Centers must be constructed and

acquired (Port Hueneme has been acquired and the site is being modified to meet our operational requirements.) Land and buildings are being purchased or leased. Personnel--including hundreds of subcontractors--are being hired, trained and integrated into MSRC operations. Insurance must be arranged, and the research and readiness programs must be launched. However, much has been accomplished. MSRC's efforts thus far can be put into perspective when viewed against the recommendations of the actions taken to implement the Skinner/Reilly Report.

The Marine Spill Corporation (MSRC) was established in September 1990 as a not-for-profit organization focused on providing oil spill response capabilities in coastal, tidal and certain rivers of the United States. These capabilities were described in planning done under the name of the Petroleum Industry Response Organization (PIRO). The capabilities will supplement whatever response capabilities already exist in various localities and will provide the resources to deal with spills of approximately the size of the T/V Valdez accident in each of five geographic regions.

The Marine Preservation Association (MPA) is also a not-for-profit corporation whose purpose is to provide support to oil spill response organizations. A member of MPA may cite MSRC as a response resource in the spill response plans required of them under the Oil Pollution Act of 1990.

The target date for full establishment of MSRC capabilities is February 19, 1993, the date required by OPA-90.

STATUS

The Skinner-Reilly Report to the President on "Oil Spill Contingency Planning - National Status" contained 21 recommended actions to improve the nation's ability to respond to catastrophic oil spills. Fourteen of those recommendations involve actions which are either governmental responsibilities or which have been essentially met in various provisions of the "Oil

Pollution Act of 1990". Each of the seven remaining recommended actions involve the private sector to a greater or lesser extent. Each of these seven recommendations is being addressed by the Marine Preservation Association. What follows is a brief description of actions taken to date by MSRC and MPA.

Recommendation 4: "Stockpile larger amounts of state-of-the-art oil spill response equipment".

Action: MSRC through the support of MPA is placing more than $400 million in response vessels, barges, skimming and containment equipment etc. in 5 geographical regions involving 27 sites in 23 coastal states Puerto Rico and the Virgin Islands. Each response region is being designed to have the capacity to respond to a spill of approximately the T/V Valdez size, the largest spill ever to occur in U.S. waters. If needed, equipment and response personnel will be brought to the accident from other regions. Equipment is being located within each region where the highest risk of accident exists. This is in addition to other substantial increases in equipment which have been made to many industry spill cooperatives, especially those in Alaska.

Recommendation 5: "Provide response managers with a larger cadre of trained personnel".

Action: MSRC's operating concept is to carry our response activities under the direction of the responsible party, through a force of hundreds of subcontractors, using for the most part MSRC equipment, and working under the direction of MSRC supervisors. MSRC subcontractor personnel will be trained and drilled by MSRC. Frequent periodic retraining and drills will be required to maintain skills. Most importantly, MSRC will develop and regularly evaluate/exercise its own staff in all

aspects of spill response including spill response management techniques, equipment operations and spill communications. Together, MSRC personnel with its trained subcontractors will be a large, mobile cadre of responders. This level of capability has never been available anywhere.

Recommendation 6: "Challenge response contractors"

Action: MPA and MSRC's actions in creating this greatly expanded capability is acting as a strong stimulant to other response organization and equipment manufacturers throughout the country and internationally to improve and enhance their capabilities.

Recommendation 7: "Industry should lead aggressively in rebuilding our national oil spill response capability since it has primary responsibility for cleaning up oil spills".

Action: The petroleum industry is committed to a massive effort to improve national response capabilities in the private sector. The cost of doing this is now estimated to be in excess of $800 million over the first five years. This is several times the original estimate of costs. In spite of this increase in estimated cost, the creation of MSRC and MPA by the industry amply demonstrates the continuing commitment to meeting its responsibilities.

Recommendation 12: "Develop additional tools to support comprehensive planning for environmental features".

Action: A sophisticated computer based decision support system is being developed by

MSRC. Appropriate federal agencies (e.g. EPA, USCG, NOAA, MMS, etc.) are involved in advising on various aspects of that system. When finished, this system will put a powerful response management tool in the hands of those responsible for oil spill responses. A comprehensive decision support system of this type has never been available in major spills.

Recommendation 16: "Strengthen research and development"

Action: MSRC through MPA's support will manage and direct a $35 million R&D program over the next 5 years, directed at improving overall capabilities to contain and remove spilled oil. This represents a quantum increase of R&D effort in this area. It will be closely coordinated with others, especially government and industry to avoid duplication and maximize collaborative opportunities. As a not-for-profit corporation, MSRC has adopted the position that R&D efforts will be made available to the public in a manner that will foster widespread awareness and implementation of new developments.

Recommendation 17: "Improve operational communications".

Action: MSRC is developing fully mobile communications capabilities for each of its 5 regions. Each region will be able to communicate with sufficient capacity to handle the communication needs in a spill of the general size of the T/V Valdez. Multiple modes (e.g. satellite, VHF HF etc.) for both voice, code, data and facsimile will be provided. Sufficient redundancy will be provided to ensure continued operations in the case of casualty.

Mr. Chairman, I hope this information helps the Joint Committee in understanding MSRC's role in major oil spills and our status of development. MSRC is working hard along a broad front to complete our implementation. We would be happy to respond to any questions you may have.

DRAFT

MMS Oil Spill Response Research Program Plan

FY 1992 - FY 1996

May 9, 1991

Introduction - The MMS proposes to expand and accelerate its existing oil spill response research program consistent with the expanding internal budget and provisions of the Oil Pollution Act of 1990. The program has made significant advances in oil slick detection with surface ship's radar, the laser fluorosensor, and slick thickness sensor; in mechanical containment and cleanup with development of standard performance test protocols and down-wave/wind containment techniques; in-situ burning with proving the feasibility and quantification of airborne pollutants; in chemical treating agents with development of laboratory effectiveness protocols (in excess of 14,500 evaluations of various chemical treating agents); and in information interchange with the publication of the "1991 (Third) Edition of the World Catalog of Oil Spill Response Products." Other projects involve the evaluation of effects of various cleanup techniques as well as oiling of beachline types. A major effort has addressed the effects of weathering of oil on cleanup techniques.

The following represents MMS's proposals for a balanced research effort to address these facets of oil spill response which can most substantively improve over the next 5 years. The program description is categorized by major response concerns.

Surveillance/Tracking/Modeling

Existing remote sensing equipment are either weather dependent or consistently show false images which require visual confirmation. Wind patterns, fresh oil, fresh water, silt, seaweed, etc., all show as potential oil slicks. A number of improvements can be achieved in reliability of these systems by upgrading selected components. Existing ultraviolet and infrared detection systems for use from aircraft represent 30-year-old technology and are no longer available for system replacement. Evaluations of various radio and satellite monitored oil spill drifter buoys have been undertaken with uncertain results. Several drifters have been identified which drift at 3 to 3 1/2 percent of the wind speed which is the traditional value used to predict slick movement. Although some "at sea" experiments have been carried out in the presence of oil, the results are still not conclusive. Further evaluations at oil spills are necessary to perfect these drifters so that slick movement can be predicted in areas of complex and dynamic conditions such as near-shore and tidally affected estuaries. Additional efforts are required to improve our understanding of the chemical and physical changes in spilled oil over time. These changes have major implications on the most effective response strategies.

D.1 - **Oil Thickness Sensor Development.** Accelerate development of airborne oil thickness sensor packages using either a microwave or laser system capable of being flown in small corporate-type, twin-engine aircraft.

D.2 - **Laser Fluorometer Development.** Accelerate and field verify airborne packages capable of discriminating between biogenic oil, nonoil targets, and petrogenic oil. One such system under investigation is the laser-fluorosensor which will require additional funds. Other approaches should be explored.

D.3 - **UV-IR Systems Development.** Develop state-of-the-art ultraviolet and infrared false color systems to remotely indicate the presence of oil. Current technology is neither solid state nor readily available.

D.4 - **Oil Spill Radar Development.** Develop and evaluate specialized radar systems coupled with spectral analysis of the return signal. This approach shows promise of reducing other ocean surface effects which presently appear as oil slicks on existing Side-Looking-Airborne-Radar systems.

D.5 - **Rapid Image Processing and Data Management.** Develop data recording and rapid data management methods to exploit remote sensing for emergency management. Read-write optical

disk and VHS-Video technologies will be evaluated for the development of a practical method to record multispectral scanner data in a format that is immediately compatible with image processing and data management methods that can be used with computer resources and formats in emergency operations.

D.6 - **Remote Sensing of Stranded Oil.** Define a practical and optimum sensing package for remote sensing of oil spills for supporting emergency operations. Emphasis will be on oil spills on land and shorelines. Satellite and aircraft sensor packages will be considered.

D.7 - **Develop Improved UV-IR Systems Field Test.** Conduct intensive field evaluations of new ultraviolet/infrared/ false color sensing packages with adequate ground truthing.

D.8 - **Field Test of Marine Radar for Oil/Water Surveillance.** Conduct field evaluation of specially tuned shipboard navigational radar for remote detection of oil slicks. This system has been utilized on several recent spills but ground truthing is lacking. This should be conducted in concert with the laser thickness sensor field verification.

D.9 - **Sensors for Submerged Oil.** Conduct several investigations of methods for detecting and tracking

submerged oil concentrations. Recent research has identified several mechanisms which can cause the submergence of spilled oil. Occurrences of significant beachline oiling have been reported where no oil had been visible seaward of the surf zone. Two projects already planned require acceleration. These include evaluation of commercially available fish-finding sonar units and the use of light-blue airborne lasers to penetrate the water column and fluoresce in the presence of oil.

Spilled Oil Behavior/Properties

The physical and chemical properties of spilled oil change rapidly on the ocean surface. Viscosity, pour point, water content, density, and emulsification all have important implications to the effectiveness of various spill response strategies. The mechanisms inducing these changes are not sufficiently known to predict the behavior of various types of oil to optimize the spill response.

P.1 - **Evaluation and Modeling of Physical Behavior of Spilled Oil.** Accelerate ongoing investigations into the chemical and physical properties of various types of oil as a function of photoxidation, emulsification, evaporation, incorporation of bound water and sediment, etc. The goal is

a predictive capability for physical and chemical properties by oil type and existing sea and weather conditions.

P.2 - **Identify Physical Behavior of Spilled Oil.** Conduct field verification of the model using a range of oils and climatic conditions through spills-of-opportunity or intentional releases of oil.

Trajectory Modeling

T.1 - **Spread of Oil in Water.** Develop improved models for the spreading of spilled oil on water incorporating weathering algorithms from above projects.

T.2 - **Shoreline Oil Movement.** Develop predictive models which address the trajectories of oil in the near-shore environment including stranding and redistribution of the slick back into the ocean surface as a function of tidal and wave action.

T.3 - **Develop Oil Spill Cleanup Models.** Develop analytical model to calculate movement, spreading, slick fragmentation, droplet formation, and ultimate disposition of oil spill at sea. Model will include interaction of the spill with shoreline.

T.4 - **Develop Near Coastal and Open Ocean Oil Spill Transport Model.** Develop and implement numerical models to simulate the transport of contaminants and remediation agents in ocean oil releases. Integrate large scale atmospheric and ocean circulation data with chemical/biological remediation processes to derive small scale 3D simulations. The ultimate result is a model to predict contaminant fate and guide mitigation strategies.

On Water Containment/Recovery/Treatment

Containment

C.1 - **High Seas Containment Devices.** Develop and evaluate improved methodologies for containing oil on the open ocean. This involves redesign of containment booms and other methods involving water jets and other maneuvering procedures.

C.2 - **Capabilities in Pack Ice.** Develop and evaluate improved containment strategies for broken-ice conditions, including ice reinforced booms, nets, etc.

C.3 - **Maneuvering Ice Floes for Containment.** Develop and evaluate methods for utilizing the natural containment characteristics of pack ice to enhance spill response

capabilities. This may be accomplished by maneuvering ice floes to form containment booms.

C.4 - **Artificially Thicken Ice.** Develop and evaluate techniques to artificially thicken ice to increase its oil retention capabilities. Under conditions where pack ice is slowly moving, creation of sorbent snow banks, bonding existing floes, and providing for increased under-ice retention by increasing the thickness and insulation capabilities. This includes field verification.

C.5 - **High Currents.** Develop and evaluate improved barrier designs to contain, exclude, or divert spilled oil in high current areas. Other strategies such as water-jet containment also would be part of this project area. Limited field verification using oil substitutes are planned in this project area.

Mechanical Recovery

Investigate, develop, and test innovative oil spill recovery techniques and equipment for adverse environments such as high current areas and ice-infested waters.

R.1 **Recovery In and Under Ice.** Develop and evaluate innovative techniques to recover oil from and under

broken and solid ice. This is anticipated to involve a series of projects using field evaluations with oil substitutes. Projects include improved oleophylic skimmer designs to retrieve oil while mechanically handling a minimum of ice. Additional experiments on under ice recovery are planned.

R.2 **High Currents.** Conduct basic studies on oil-water equipment interaction at high current velocities to determine if design of improved equipment is feasible. If feasible, improved designs will be field evaluated utilizing oil substitutes.

Sorbents

Sorbents provide an effective recovery option for smaller spills, spills in confined areas, and shoreline protection. Survey various products on the market and compile user database of product characteristics and effectiveness, application techniques, and disposal techniques.

S.1 **Sorbents - Use of Snow Banks.** For arctic applications, the use of conventional sorbents is not practical because of high logistical demands of this strategy. This project will evaluate the oil retention potential of naturally occurring

or artificially produced snow to absorb oil for later remedial action including burning.

Standard Performance Testing

Develop standard test protocols for oil spill cleanup equipment, i.e., booms and skimmers, as joint project with MMS and Environment Canada.

Provide financial and logistical support to the Oil and Hazardous Materials Simulated Environmental Test Tank (OHMSETT) as member of the OHMSETT Interagency Technical Committee. Participate in the identification of systems and equipment for testing, including representative commercially available systems and equipment; and innovative techniques, systems and equipment for R&D.

Conduct at-sea testing of systems and equipment that has performed well at OHMSETT, providing coordination and logistics.

Offshore oil spill response equipment including booms and skimmers have not been evaluated in such a way that direct comparisons of performance capabilities can be extrapolated. This project area involves development of standardized test

protocols to develop predictive capabilities for performance of specific equipment.

R.1 **Evaluate Equipment.** Evaluate performance for offshore booms and skimmers. This funding provides for two at-sea performance evaluations with oil.

R.2 **OHMSETT.** Maintain the OHMSETT test facility on a near-year-round availability without charging a day charge. It also provides $1.25 million for necessary maintenance and refitting of systems for FY's 1991-93.

R.3 **Innovative Skimmers.** Several innovative skimmer designs have been developed in the past several years and will be evaluated at OHMSETT.

On Water Oil Treatment

In-Situ Burning. Accelerate efforts to delineate the efficiency of in-situ burning as a function of oil type, temperature, degree of weathering, and emulsification; and the production and dispersion of airborne contaminants. Provide funding and logistical support for meso-scale tests to be conducted at the U.S. Coast Guard Fire and Safety Test Facility in Mobile. Provide funding and logistical support for the Louisiana open-sea burn. Concurrently define the legal, environmental, and safety issues [illegible] protocol.

B.1 [illegible]

B.2 [illegible]

B.3 [illegible]

B.4 [illegible]

issues associated with in-situ burning, and develop a decision protocol.

B.1 **Airborne Constituent Behavior.** Accelerate the development and evaluation of field verification methodology for airborne constituent behavior during experimental and operational in-situ burning. Plume behavior prediction is necessary for the full acceptance of this response technique. This involves the modeling and verification for a number of spills.

B.2 **Emulsions.** Develop methodologies to improve and sustain combustion of emulsions. This includes use of burning enhancers, improved igniters, and improved methods for reconcentrating the spill during combustion.

B.3 **Reduction in Airborne Pollutants.** Develop improved methods to reduce the quantity of airborne pollutant loading through increased oxygenation, and reprecipitation of particulate combustion products back in the flame. Four projects are planned for this research area.

B.4 **Decision Documents.** Develop and accept practical operational decision documents for rapid utilization of this response strategy. The decision process is similar to dispersants with additional safety issues to be included.

This aspect is necessary for the acceptance of this response strategy. Decision processes will be incorporated into Oil Spill Contingency Plans for OCS oil and gas operations.

B.5 **Field Verification.** Conduct several field verifications of this response strategy in a range of conditions with various oils, using the most complete sampling and analysis program practical. This is necessary for widespread acceptance of the technique.

B.6 **Measure Burning Effects.** Develop and field verify techniques to evaluate the environmental and biological effects of these response strategies in comparison with the effects of spilled oil which is not burned.

Chemical Technology

Recent joint MMS research has developed standardized evaluation techniques for several classes of chemical treating agents including dispersants, surface washing agents, elasticity agents and de-emulsifiers. These funds will be used to evaluate these agents in tank tests and in the field.

C.1 **Improved Treating Agents.** Accelerate existing MMS research for reformulation of dispersants to increase their

15

effectiveness on high molecular weight carbon compounds in crude oils and refined products.

C.2 **Effectiveness Measurement Techniques.** The controversy over the field effectiveness of dispersants is due, in part, to the inability to conduct accurate and repeatable evaluations. This project, coupled with the laser fluorosensor and laser thickness sensor, will seek to develop accurate effectiveness measurements in the field on actual spills.

C.3 **Research Dispersant Process.** Accelerate existing MMS research on the mechanism of action of dispersants and nondispersants. Conduct reformulation experiments to improve effectiveness. This includes toxicity evaluations of the new formulations.

C.4 **Improved Aerial Application.** A major reason for the lack of effectiveness of dispersants is hypothesized to be improper aerial application techniques. This is partially indicated by the high effectiveness ratings of premixed dispersants compared with significantly lower effectiveness data from field applications. This project area contains several investigations to evaluate and improve existing dispersant application techniques.

Chemical Washing Agents

The MMS has initiated research to develop standard test procedures for washing agents which can yield repeatable results. Funds, as part of this program, will provide for an acceleration in the development of standard performance test protocols and for testing.

C.5 **Subsurface Movement.** The behavior of chemically treated oil in terms of its vertical movements in interstitial spaces in beach sediments and the stranding, refloating, and restranding of oil due to wave and tidal action will be evaluated.

C.6 **Field Test of Cleanup Techniques.** Compare the effects of beachline cleanup techniques on various shoreline types including rocky intertidal, cobble/gravel, coarse sand, muddy marsh intertidal, fine sands, and coral-mangrove-shore types. Provide matrix comparisons on recolonization and natural restoration of impacted shorelines as a function of degree and type of oil exposure. Address degree of cleanliness as achieved with varying levels of effort using mechanical, chemical, and biological remediation techniques and "how clean is clean" for shoreline impacts.

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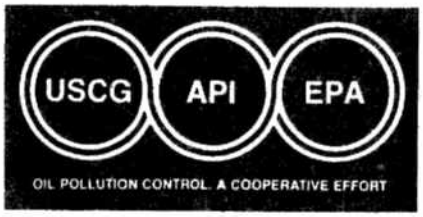

RECENT RESULTS FROM OIL SPILL RESPONSE RESEARCH

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ABSTRACT: *Recent large oil spills from tankers have reaffirmed the need for continuing technology assessment and research to improve oil-spill response capabilities. The Minerals Management Service (MMS) remains a lead agency in conducting these studies. This paper discusses MMS concerns, as reinforced by the acceleration of its research program in 1990. It briefly assesses the current state-of-the-art technology for major aspects of spill response, including remote sensing, open-ocean containment, recovery, in-situ burning, chemical treating agents, beach-line cleanup, and oil behavior.*

The paper reports on specific research projects that have begun to yield information that will improve detection and at-sea equipment performance. The first detection project, for which MMS has patent pending, involves the use of shipboard navigational radar to track slicks at relatively long range. The second project involves the use of conventional containment and cleanup in a downwind mode, which is contrary to the traditional procedures.

The paper also discusses current research projects, including the development of an airborne, laser-assisted fluorosensor that can determine whether apparent slicks contain oil. Additional projects involve the development of improved strategies for responding to oil in broken-ice conditions, for gaining an improved understanding of the fate and behavior of spilled oil as it affects response strategies, and for reopening and operating the oil and hazardous materials simulated environmental test tank (OHMSETT) facility in Leonardo, New Jersey. Recent progress on the development of safe and environmentally acceptable strategies to burn spilled oil in-situ is also discussed. The OHMSETT facility is necessary for testing prospective improvements in chemical treating agents and to develop standard procedures for testing and evaluating response equipment.

A number of factors have to be considered in the evaluation of the adequacy of spill response. These include sea state and weather conditions, type of oil, size of spill, elapsed time from spill to response, presence of ice, and level of response effectiveness. Readiness includes the siting of sufficient equipment and trained personnel to address spill response issues. A major aspect of preparedness is the state-of-the-art technology of existing equipment and procedures, including capabilities for detection, containment, recovery, disposal, alternative responses—e.g., chemical treating agents and in-situ burning.

Detection

Practical oil-spill detection is still done by visual observation, which is limited to favorable sea and atmospheric conditions and is not possible in rain, fog, or darkness. Airborne remote sensing packages have been developed using side-looking radar, infrared and ultraviolet/false color cameras. These systems are not resources usually available to responders.

Minerals Management Service (MMS) research has produced a method of specially tuning shipboard navigational radar to track oil spills under all except extremely rough sea conditions. This technique has been used successfully on three successive oil spills.[4]

This detection technique has been successful in locating spills as small as 5 barrels at a distance of 12 nautical miles. It depends upon harmonic resonance of X-band radar as a result of back scattering from short (~5 cm) wavelength wave trains. These waves occur at sea in wind velocities from about 3 knots up to hurricane force. In repeated trials off Nova Scotia in 1987, the presence of significant breaking seas coupled with large swells (>1.5 m) obscured the slick. It is unclear whether this was a wave-induced phenomenon or whether the small slicks were rapidly dissipated and no longer detectable. Fog and rain had no effect on detection. There is an apparent correlation between slick thickness and the radar image. As the slicks dispersed to sheen thickness, the radar imagery became less distinct.

Before the radar technique can become a reliable operational tool, additional research is necessary to correlate slick characteristics, e.g., slick thickness and sea conditions with the radar presentation. The completion of an MMS/Esso Research Ltd., Canada, and Environment Canada (EC) research effort to design and evaluate an airborne laser thickness sensor for oil slicks will help provide additional information.

The airborne laser thickness sensor for oil slicks has been thoroughly evaluated in the laboratory; and potentially, a system can be made flyable within the next two years. Presently, airborne remote sensing packages cannot discriminate between areas of a slick that are thick enough to recover and portions too thin for such action. Observations indicate that slicks do not dissipate uniformly at sea. Most of the oil remains in small areas of concentration when compared to the total area of the slick. Future studies will address the airborne sensors' capability to transmit the location and configurations of the thicker portions of the slick to the responder in real time.

Existing remote sensing packages routinely report false slicks. This may be overcome when weather conditions allow the joint use of side-looking airborne radar (SLAR) and ultraviolet and infrared sensors. Visual confirmation of oil remains the most certain detection technique. Still other features—such as fresh oil, freshwater inflows, seaweed, tidal rip lines, or debris—can be mistaken for oil slicks.

The EC began a research project, which MMS joined in 1987, to develop a system that could be transported in small twin-engine aircraft and could discriminate between spurious targets and those containing oil. Laboratory tests show that the airborne laser fluorosensor can distinguish between biogenic and petrogenic oil. This system also appears to have potential for identifying oil on shorelines and in broken ice conditions. Since it uses lasers, it should offer a significant increase in detection capabilities. The MMS anticipates that an experimental system will be flyable within the next 18 months.

Containment

Capabilities for using open-ocean booms to contain oil are unquantified in waves over 2 to 3 feet. Yet these wave heights are often exceeded on the Outer Continental Shelf (OCS). Conventional knowledge indicates that containment booms will not operate effectively in wind speeds over 15 to 20 knots or at tow speeds exceeding 0.5 to 0.75 knots. During MMS/EC experimental oil-spill operations conducted off the coast of St. John's, Newfoundland, oil was successfully contained by booms towed with the wind, instead of against it, in contravention of conventional practice. This new technique resulted in successful slick containment in winds up to 35 knots and at tow speeds up to 1.4 knots.[6]

Currently, more than 30 different boom designs are in use in the OCS. The relative capabilities of these booms have not been properly quantified for lack of a standardized testing technique or protocol. The MMS, EC, U.S. Coast Guard, (USCG) and Environmental Protection Agency (EPA) initiated in 1985 the development of an extensive test protocol that would rate the performance of containment booms without requiring the intentional spillage of tens of thousands of gallons of oil as is the current international practice. This protocol was evaluated and verified off the coast of Newfoundland in 1987.[7] Standard nonpolluting test procedures are being devised to evaluate the performance of each containment boom in a wide range of sea states.

Recovery

Several offshore skimmers of differing oil retrieval concepts have been evaluated at OHMSETT, and elsewhere, in realistic offshore conditions. Additional testing of conventional systems would be of minimal value. However, MMS, EC, USCG, and the American Petroleum Industry (API) are jointly searching for innovative skimmers for evaluation. One such skimmer, based on a Finnish prototype, appears to have significant potential for oil recovery in a wide range of broken ice conditions. This device makes use of proven ice-handling techniques, efficiently contacting the oil slick with minimal ice movement. Negotiations on testing this skimmer are continuing.

Chemical treating agents

Chemical treating agents fall into 11 major categories including sorbents, solidifiers or gelling agents, sinking agents, surface washing agents, dispersants, biodegradation agents, biodegradation enhancers, de-emulsifiers, burning agents, and herding agents. In 1987, MMS and EC began to develop a better understanding of the mechanism of dispersant action. This task was undertaken because of controversy over the field effectiveness of dispersants and because laboratory effectiveness measurement protocols did not yield reproducible data. Laboratory tests were normalized using more realistic oil to water ratios and allowing a settling time prior to the effectiveness evaluations. This new test yielded reproducible (within 5 percent) results and was used to evaluate a range of crude oils and products with commercially available and experimental dispersants.[8] Table 1 shows the results of this research.

When oil to water ratios of 1 to 1,000 and settling times of 10 minutes were used with traditional laboratory effectiveness protocols—including the Labofina, Mackay, and the Swirling Flask—techniques showed reproducible results for most of the oils listed in Table 1.

Additional research on emulsion inhibitors and visco-elastic agents have been conducted by MMS and EC both in the laboratory and at sea.[9] Both treating agents were successful. The demulsifier significantly inhibited the formation of emulsions or broke up emulsions while the oil was on the ocean surface. Demulsifier was used at concentrations ranging from 250 to 4,000 ppm. The visco-elastic agent also performed well in the laboratory and at sea. Laboratory and tank tests indicated that under certain conditions skimmer recovery rates could be increased by an order of magnitude. At sea, emulsion formation was inhibited and the adhesive character of the oil increased by concentrations of 1,000 to 10,000 ppm. Both treating agents modified the characteristics of the oil to enhance significantly its recoverability and burnability in situ.

The MMS, EC, and API is continuing research to identify and evaluate other chemical treating agents.

In-situ burning

The major advance in spill response has resulted from joint research begun in 1983 to determine the limiting conditions for burning oil on the surface of the open ocean. This effort was conducted at the OHMSETT facility in Leonardo, New Jersey. Prudhoe Bay, Amauligak, and several other crude oils were evaluated to determine the effects of selected physical variables including slick thickness, weathering, sea state, wind velocities, air and water temperatures, degrees of emulsification, and degrees of ice coverage. All of the tested oils burned with 50 to 95 percent removal ratios, as long as emulsification had not occurred. Effects of ice coverage up to 98 percent, wind speeds to 50 knots, and water temperatures from −1° to 35°C were minimal to the outcome. Weathered, but not emulsified, oils burned with a higher percentage of removal than did fresh oils. This was unexpected but appears to be a function of increased viscosity as weathering occurs.

Based upon this research, MMS began to explore how major burns affect air quality. A joint research effort with EC began in 1985 to quantify burn products and to model the behavior of the products as a function of time and cooling. This research was conducted, under contract, by the National Institute of Standards and Technology. The modeling uses a Department of Defense "nuclear winter" computer model, which addresses the behavior of the smoke plumes from numerous fires in a defined area.[10] Continuing analyses of airborne pollutants indicate that dioxins, furans, and polynuclear aromatic hydrocarbons (PAH) are not generated as a result of combustion. The PAH compounds in the oil are partially destroyed or converted to higher molecular weight compounds, which are less acutely toxic.[4] The next phase of this research will evaluate the scaling effects on efficiency, pollutant loading, and airborne plume behavior. This is scheduled for the summer of 1990 with at-sea verification in 1991–92.

Results indicate that within certain constraints, in-situ burning should be considered as a primary response strategy especially in remote areas where logistics play a key role in limiting conventional response capabilities.

Oil characteriztion

Oil properties, which significantly affect spill response, change rapidly after initial contact with the ocean surface. Physical properties—pour point, viscosity, density, water content, etc.—change rapidly as a result of evaporation, photooxidation, emulsification, sediment loading, evaporation, adhesion to debris, and other causes. The MMS joined with EC in 1986 to evaluate the effects of the most significant weathering phenomena. Of particular interest were the more exotic oils, such as the heavier oils produced offshore in California. Significant changes in physical properties of these and other oils have been reported.[11,12]

OHMSETT

The MMS with cooperative support from the USCG and EC have initiated a major effort to refurbish and reinitiate research at the OHMSETT facility. This open-air test tank has the capability of testing oil recovery equipment in oil and in repeatable wave conditions while towing. Approximately 95 percent of the performance data on recovery equipment was generated at OHMSETT. The facility will be used to evaluate and develop new and innovative oil-spill response strategies.

Shoreline cleanup

The MMS, with EC, began in 1986 to develop a matrix analysis program to evaluate various beachline cleanup techniques. The effec-

Table 1. Dispersant effectiveness

Oil	Dispersant	Effectiveness (percent) Average	Premixed	1 drop	2 drop
ADGO	C 9527	61	61	82	41
ADGO	CRX-8	39	61	31	26
ADGO	ENER 700	59	76	53	47
ADGO	DASIC	8	11	7	5
ADGO	C9527	45	50	36	49
Amauligak	CRX-8	50	61	51	37
Amauligak	ENER 700	62	65	62	59
Amauligak	DASIC	28	23	40	22
Amauligak	DREW	0	TL	TL	TL
Amauligak	C 9550	0	TL	TL	TL
Amauligak	BQ	60	72	52	57
Amauligak	II	0	22	TL	TL
Amauligak	C 9527	17	31	16	3.3
Arabian light	CRX-8	9	15	8.6	4.8
Arabian light	ENER 700	22	16	27	23
Arabian light	DASIC	33	24	36	40
Arabian light	BQ	42	28	54	43
Arabian light	C 9527	33	42	28	28
ASMB	CRX-8	45	57	43	35
ASMB	ENER 700	51	68	51	35
ASMB	DASIC	24	18	27	28
ASMB	DREWLT	0	TL	TL	TL
ASMB	C 9550	0	TL	TL	TL
ASMB	BQ	79	81	82	73
ASMB	II	18	49	5	0
ASMB	WELLAID 3315	14	8	12	21
ASMB	BP1100WD	12	6	14	17
ASMB	BP1100X	12	6	14	17
ASMB	C 9527	39	59	31	27
Atkinson	CRX-8	31	67	19	7
Atkinson	ENER 700	73	79	75	66
Atkinson	DASIC	49	33	61	53
Atkinson	C 9527	11	18	7.5	8
Avalon J-34	CRX-8	5	7.6	5.3	3.3
Avalon J-34	ENER 700	11	15	12	7
Avalon J-34	DASIC	16	8	18	21
Avalon J-34	BQ	10	11	11	7.1
Avalon J-34	C 9527	10	14	10	5.7
Avalon zone 4	CRX-8	7	14	4.2	3.1
Avalon zone 4	ENER 700	7	14	4.2	3.1
Avalon zone 4	DASIC	30	12	40	38
Avalon zone 4	BQ	13	16	14	10
Avalon zone 4	C 9527	17	12	17	21
Bent Horn	ENER 700	23	10	18	42
Bent Horn	DASIC	35	14	43	48
Bent Horn	C 9527	1	2.3	1.1	1
Bunker C	CRX-8	2	3.8	1.3	0.9
Bunker C	ENER 700	1	0.9	1.9	0.8
Bunker C	DASIC	2	2.1	2.9	0.5
Bunker C	BQ	1	1.4	1.4	0.8
Bunker C	C 9527	1	0.6	1	0.4
Bunker C light	CRX-8	1	0.7	0.9	0.7
Bunker C light	ENER 700	1	0.7	2	1.5
Bunker C light	DASIC	1	0.6	1.7	1.3
Bunker C light	BQ	2	1.6	2.6	0.8
Bunker C light	C 9527	1	0.5	1.1	0.9
California crude (11.0)	CRX-8	1	2.3	1.2	0.8
California crude (11.0)	ENER 700	1	1.4	2.7	0.8
California crude (11.0)	DASIC	1	0.2	2.2	0.8
California crude (11.0)	BQ	1	0.4	2.2	1.7
California crude (11.0)	C 9527	1	1.3	0.7	0.3
California crude (15)	CRX-8	1	0.4	0.8	0.6
California crude (15)	ENER 700	1	0.9	0.9	1
California crude (15)	DASIC	2	0.8	3	3.3
California crude (15)	BQ	1	1.4	1.3	0.8
Cohasset	C 9527	95	88	108	98
Cohasset (11.2%)	C 9527	96	88	99	100
Cohasset (25.6%)	C 9527	88	75	92	97
Cohasset (28.1%)	C 9527	90	74	97	100
Cold Lake bitumen	C 9527	2	1.9	2.3	0.4
Cold Lake bitumen	CRX-8	1	1.1	2.1	0.6
Cold Lake bitumen	ENER 700	1	0.9	1.4	0.4
Cold Lake bitumen	DASIC	1	1	1	0.3
Cold Lake bitumen	BQ	1	1.1	1.5	0.3
Endicott	C 9527	7	17	2.3	2.8
Endicott	CRX-8	8	20	1.3	2.4
Endicott	ENER 700	6	10	2.4	6.4
Endicott	DASIC	14	8.1	15	18
Endicott	BQ	13	18	6.9	13
Endicott	C 9527	3	3	3	3
Endicott (7.5% w)	CRX-8	4	5	3	3
Endicott (7.5% w)	ENER 700	6	4	6	9
Endicott (7.5% w)	DASIC	4	1	1	11
Endicott (7.5% w)	BQ	6	4	6	7
Endicott (7.5% w)	C 9527	2	2	2	2
Endicott (11.7% w)	CRX-8	2	2	3	2
Endicott (11.7% w)	ENER 700	6	2	9	6
Endicott (11.7% w)	DASIC	3	1	3	4
Endicott (11.7% w)	BQ	4	1	6	6
Endicott (11.7% w)	C 9527	25	41	24	11
Federated	ENER 700	40	41	56	22
Federated	DASIC	38	23	55	35
Federated	BQ	64	66	85	42
Federated	C 9527	6	13	1.9	1.8
Hibernia	CRX-8	6	14	2.6	2
Hibernia	ENER 700	10	7.3	10	14
Hibernia	DASIC	14	8.6	18	16
Hibernia	BQ	9	7.8	12	6
Hibernia	WELLAID 3315	4	3	4	4
Hibernia	C 9527	4	6.1	2.3	2.5
Hibernia (15.4%)	CRX-8	3	5.8	1	2
Hibernia (15.4%)	ENER 700	8	5	11	7.5
Hibernia (15.4%)	DASIC	7	1	8	11
Hibernia (15.4%)	BQ	5	4	6	4
Hibernia (15.4%)	C 9527	66	70	93	35
Isuungak	CRX-8	60	58	75	47
Isuungak	ENER 700	62	51	79	57
Isuungak	DASIC	51	31	60	61
Isuungak	BQ	77	77	69	84
Isuungak	C 9527	5	9.5	3.6	1.5
Lago Medio	CRX-8	5	13	1.8	1.4
Lago Medio	ENER 700	13	11	21	5.9
Lago Medio	DASIC	15	4.1	18	24
Lago Medio	BQ	18	22	25	6.3
Lago Medio	C 9527	6	9	5	3
Mousse Mix	CRX-8	9	15	8	5
Mousse Mix	ENER 700	14	10	19	13
Mousse Mix	DASIC	17	9	22	20
Mousse Mix	BQ	18	25	17	12
Mousse Mix	II	6	15	3	0
Mousse Mix	C 9527	36	51	40	17
Norman Wells	CRX-8	43	60	38	30
Norman Wells	ENER 700	51	73	26	53
Normas Wells	DASIC	26	19	33	27
Norman Wells	DREWLT	0	TL	TL	TL
Norman Wells	C 9550	0	TL	TL	TL
Norman Wells	BQ	77	83	80	68
Normas Wells	II	0	33	TL	TL
Panuk	C 9527	96	95	95	97
Panuk	CRX-8	78	100	62	71
Panuk	ENER 700	96	93	97	99
Panuk	DASIC	40	44	38	37
Panuk	BQ	100	100	100	99
Panuk	C 9527	99	96	100	100
Panuk (47.4% w.)	C 9527	99	96	100	100
Panuk (53.2% w.)	C 9527	13	19	13	7
Prudhoe Bay	CRX-8	13	23	9	6
Prudhoe Bay	BQ	32	43	29	24
Prudhoe Bay	ENER 700	35	48	26	31
Prudhoe Bay	DASIC	11	14	14	18
Prudhoe Bay	C 9527	7	13	5.8	2.5
Prudhoe Bay (1989)	CRX-8	7	15	3.2	3.9
Prudhoe Bay (1989)	ENER 700	10	15	3.1	13
Prudhoe Bay (1989)	DASIC	14	11	18	13

Table 1. Dispersant effectiveness—Continued

Oil	Dispersant	Effectiveness (percent) Average	Premixed	1 drop	2 drop
Prudhoe Bay (1989)	BQ	15	25	4.8	16
Prudhoe Bay (1989)	WELLAID 3315	4	3	5	3
Prudhoe Bay (89) (7.6% w)	C 9527	6	9	3	5
Prudhoe Bay (89) (7.6% w)	CRX-8	6	13	3	3
Prudhoe Bay (89) (7.6% w)	ENER 700	16	8	25	16
Prudhoe Bay (89) (7.6% w)	DASIC	16	12	19	18
Prudhoe Bay (89) (7.6% w)	BQ	19	29	18	10
Prudhoe Bay (89) (14.5% w)	C 9527	4	5	4	3
Prudhoe Bay (89) (14.5% w)	CRX-8	4	8	2	3
Prudhoe Bay (89) (14.5% w)	ENER 700	8	4	6	14
Prudhoe Bay (89) (14.5% w)	DASIC	10	2	14	13
Prudhoe Bay (89) (14.5% w)	BQ	9	7	15	5
South Louisiana crude	C 9527	31	53	19	21
South Louisiana crude	CRX-8	36	55	33	19
South Louisiana crude	EVER 700	48	31	75	37
South Louisiana crude	DASIC	42	27	50	50
South Louisiana crude	BQ	62	71	80	35
Synthetic crude	C 9527	63	77	88	25
Synthetic crude	CRX-8	41	49	41	34
Synthetic crude	ENER 700	61	69	69	45
Synthetic crude	DASIC	25	23	30	21
Synthetic crude	BQ	55	89	42	34
Terra Nova crude	C 9527	16	29	13	6.5
Terra Nova crude	CRX-8	11	22	5.2	6.5
Terra Nova crude	ENER 700	28	21	38	24
Terra Nova crude	DASIC	40	19	58	44
Terra Nova crude	BQ	40	40	53	27
Transmountain blend	C 9527	8	14	6	3.1
Transmountain blend	CRX-8	8	13	5.3	6.6
Transmountain blend	ENER 700	28	17	43	25
Transmountain blend	BQ	19	25	18	15
Used motor oil	C 9527	33	42	31	27
Used motor oil	CRX-8	31	39	31	23
Used motor oil	ENER 700	36	47	32	30
Used motor oil	DASIC	29	29	27	31
Used motor oil	BQ	36	42	41	24

Notes:
- Premixed—reflects the largest amount dispersed at a dispersant to oil ratio of 1:25.
- 1 drop—reflects largest amount dispersed at a dispersant to oil ratio of 1:10. Test measures how oil/dispersant combination functions with real application.
- 2 drop—reflects largest amount dispersed at a dispersant to oil ratio of 1:10, delivered in 2 drops. Test measures the herding effect of the oil dispersant combination when compared to the 1-drop test.
- BQ and II are experimental dispersants made by EETD.
- TL—too low to measure.

tiveness on various shoreline types and the effects of the techniques on the survival of biota and natural restoration of the shoreline community were studied. A matrix analysis has been developed and priorities have been assigned to shoreline types. The cooperatives are continuing attempts to obtain the necessary permits. Field research should begin in 1992 and will address the level of ocean cleanliness and what effect the level of cleanliness will have on natural restoration of the beaches.

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U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

Washington, DC 20593
Staff Symbol: G-CC/104
Phone: (202) 366-4280

JUL 25 1991

5730

The Honorable Dennis M. Hertel
Chairman, Subcommittee on Oceanography,
Great Lakes and the Outer Continental Shelf
Committee on Merchant Marine
and Fisheries
United States House of Representatives
Washington, DC 20515

Dear Mr. Hertel:

The attached Questions and Answers for the Record are provided pursuant to your Committee hearing on June 18, 1991, on oil spill response technology. The responses have been reviewed and approved, as required, by the Department of Transportation, and the Office of Management and Budget.

Please do not hesitate to call if I can provide further assistance.

Sincerely,

T. W. Josiah
Captain, U. S. Coast Guard
Chief, Congressional Affairs Staff
By direction of the Commandant

Copy: Mr. John Rayfield

CONGRESSMAN HERTEL QUESTIONS
WITH COAST GUARD ANSWERS: 001
R & D HEARING, 18 JUNE 91

QUESTION. GAO ISSUED A REPORT IN MARCH OF THIS YEAR ESTIMATING THAT ABOUT 20 PERCENT OF THE EXXON VALDEZ COSTS ARE UNRECOVERABLE. WILL YOU PLEASE COMMENT ON THE GAO'S FINDINGS. ALSO, PLEASE TELL US HOW WE CAN AVOID PROBLEMS ASSOCIATED WITH TRACKING THESE COSTS IN THE FUTURE.

Answer. When the spill occurred, the Federal Government's response role was governed by Section 311 of the Federal Water Pollution Control Act (FWPCA), as amended. This law established the "Pollution Fund", and made it available only for response actions. The Pollution Fund was not available to pay for any and all costs or damages related to the spill. It could not, for example, pay agency costs of assessing natural resource damages, providing medical services for Native Americans, or performing normal duties outside the scope of the cleanup response directed by the Federal On-Scene Coordinator (FOSC). Therefore, to the extent that other parties cannot collect certain costs under the FWPCA, they are unrecoverable. This, however, does not preclude other actions to attempt recovery, such as a negotiated settlement, but these actions are outside the Coast Guard's scope of responsibility.

The GAO recommended that when the Coast Guard established regulations to implement the Oil Pollution Act of 1990, those regulations should describe a broader, more comprehensive range of removal activities which will be paid by the Oil Spill Liability Trust Fund. The Coast Guard concurred since this is now permitted under the Act. The Coast Guard has recently established the National Pollution Funds Center in Arlington, Virginia to develop and implement those regulations and to manage the Oil Spill Liability Trust Fund in accordance with the provisions of the Oil Pollution Act of 1990.

CONGRESSMAN HERTEL QUESTIONS
WITH COAST GUARD ANSWERS: 002
R & D HEARING, 18 JUNE 91

QUESTION. YOU EMPHASIZED THAT OIL SPILL PREVENTION IS ULTIMATELY THE MOST COST-EFFECTIVE MEANS OF PROTECTING MARINE ENVIRONMENTS. WHAT ABOUT THE USE OF DOUBLE-HULLED TANKERS? DO YOU BELIEVE THE DUAL USE OF VESSELS, SIMILAR TO THE DUTCH'S HOPPER DREDGE, IS AN EFFICIENT SAFEGUARD IN THE EVENT OF A SPILL?

Answer. The Coast Guard believes that double-hulled tankers are a significant and cost effective method of preventing oil spills. Double hulls are estimated to save 3,000 to 5,000 tons of oil spillage per year at a cost of approximately one cent per barrel transported.

The Oil Pollution Act of 1990 (OPA 90) requires double hulls on all new vessels carrying oil in U.S. waters, with existing vessels required to retrofit double hulls on a phase-in schedule beginning in 1995. All vessels, with few exceptions, will require double hulls by January 1, 2010, but in no case later than January 1, 2015.

Concerning the dual use of vessels, OPA 90 required the Secretary of the Army to conduct a feasibility study on modifying dredges for the recovery of oil and hazardous material. The Army Corps of Engineers dredges were very useful on the Exxon Valdez cleanup and I am anxious to see the results of this study.

Generally, whenever a need for a resource is identified, and that resource will be sporadically used, it makes very good sense to convert an existing resource to fulfill that other need. This is particularly true in the case of government oil skimming vessels and is the reason we were considering equipping our seagoing buoy tenders with oil skimming capabilities even before this was mandated by OPA 90. When equipped with oil recovery capabilities, our buoy tenders will be able to provide a valuable resource to Federal On-Scene Coordinators during emergency spill responses. During other times, they will be available to fulfill their primary mission of servicing aids to navigation.

CONGRESSMAN GOSS QUESTION
WITH COAST GUARD ANSWER: 001
R & D HEARING, 18 JUNE 91

QUESTION. (THIS QUESTION IS DIRECTED TO ALL OF THE PANEL MEMBERS.) ARE THE FEDERAL AGENCIES AWARE OF ANY PRIVATE COMMERCIAL EFFORTS TO DEVELOP OIL-EATING MICROORGANISMS? IF SO, ARE THESE EFFORTS BEING EXPLORED AND USED BY THE FEDERAL GOVERNMENT? PLEASE PROVIDE EXAMPLES.

Answer. Yes, National Response Team agencies are aware of a number of private commercial vendors who have developed bioremediation products, including microorganisms and nutrients (fertilizers) for treating spilled oil. The Environmental Protection Agency (EPA) is the lead federal agency dealing with bioremediation as a technology for treating spilled oil.

Examples of exploration into the development and use of this technology include product applications and evaluations at spill sites in Prince William Sound, the Gulf of Mexico, and Galveston Bay.

Following the EXXON VALDEZ accident, the EPA encouraged the submission of bioremediation products for possible use in Alaska. Thirty-nine proposals were submitted and evaluated by the EPA. Of the thirty-nine proposals evaluated, eleven products underwent laboratory testing, and two were selected for use on Alaska's shoreline. Their use and resultant findings have been publicized in several reports and at the 1991 International Oil Spill Conference.

In addition, the EPA formed the Bioremediation Action Committee (BAC) to further the advancement of this technology in February 1990. The EPA chaired the meeting which included interested industry, academic, and government personnel. The BAC has been subdivided into six subcommittees: Oil Spill Response; Treatability Protocol Development; Research; Education; Data Identification and Collection; and Pollution Prevention. One of the primary objectives of the BAC is to develop protocols for testing the effectiveness and toxicity of commercial bioremediation products. Once this work is completed, interested private sector groups will have a "standard" against which to measure how environmentally safe and effective those products are. The initial protocols are scheduled for completion by the fall of 1991.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230
OFFICE OF LEGISLATIVE AFFAIRS

AUG 29 1991

Honorable Dennis M. Hertel
Chairman, Subcommittee on Oceanography, Great
Lakes and the Outer Continental Shelf
Merchant Marine and Fisheries Committee
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Enclosed are NOAA responses to questions submitted by the Subcommittee in followup to the June 18, 1991 hearing on the state of technology in oil spill cleanup and response measures.

If you or your colleagues have any further questions, please contact me.

Sincerely,

Clifford Downen
Acting Director

Enclosure

FOLLOWUP QUESTIONS FOR DAVID KENNEDY
BEFORE THE SUBCOMMITTEE ON OCEANOGRAPHY,
GREAT LAKES AND THE OUTER CONTINENTAL SHELF
MERCHANT MARINE AND FISHERIES COMMITTEE
U.S. HOUSE OF REPRESENTATIVES
JUNE 18, 1991

1. Could you give us an idea of how you would normally divide up and assign resources to assessment, clean-up, and restoration activities? What do restoration measures entail, and how do you determine when restoration is complete?

Within NOAA, these three functions are separately funded and managed. The determination of resource needs for each of these functions is determined on a spill by spill basis. Cleanup, the first phase during a response, is primarily funded through the USCG-administered trust fund established by the Oil Pollution Act (formerly through the 311(k) fund under the Clean Water Act). The determination of the level and types of resources to be called on-scene is made by NOAA's Scientific Support Coordinator with concurrence by the U.S. Coast Guard On-Scene Coordinator.

Funding for oil spill damage assessments has, to date, come from NOAA's base program funds, from other trustees, from the spiller, from the damage assessment fund established under Title III of the Marine Protection, Research and Sanctuaries Act, or from a combination of these sources.

Decisions on whether to proceed with an assessment for a specific spill are based upon professional judgment about the probability of significant injury to NOAA trust resources, the feasibility of restoration, and the cost effectiveness of an assessment (e.g., whether the dollar value of likely damages exceeds the cost of assessment). Funding to carry out restoration work identified through the assessment process may come from the spiller through a settlement, a court award, or under certain limited circumstances, from the Oil Spill Liability Trust Fund. The Oil Pollution Act of 1990 authorizes the use of the new Oil Spill Liability Trust Fund, subject to appropriations, for the payment of initial damage assessment and restoration planning costs incurred by Federal, State, or Indian tribe trustees. Procedures for trustee access to the Fund for these purposes are being developed by the U.S.Coast Guard in consultation with the trustee agencies.

On the restoration question:

NOAA is guided by the Department of Interior's Natural Resource Damage Assessment Regulations (43 CFR Part 11) to define restoration as those actions/measures undertaken to return an injured habitat/resource to its baseline (pre-injury) condition, as measured in terms of the injured resource's structural (physical, chemical, and biological) and functional values. The latter frequently are termed "services" and include the human and other uses of the physical, chemical and biological functions of a system or resource.

In the process of restoration, NOAA strongly recommends that planning for cleanup activities and restoration occur together since the former will frequently dictate the restoration methodologies that can be employed. NOAA further recommends that whenever technically and economically feasible, on-site and in-kind restoration of the injured resource/habitat should be the primary goal. To help ensure success for any on-site restoration action, the stress or cause of the impact should be reduced. Further assessment and restoration guidelines will be issued by NOAA through the promulgation of the Natural Resource Damage Assessment and Restoration regulations required by the Oil Pollution Act.

NOAA trust habitats provide water quality, hydrologic and life support functions, and actions must strive to restore all of these functional qualities and not just pieces. There are five generic criteria that restoration efforts must demonstrate to be considered complete in providing the holistic services that occurred prior to the impact: (1) sustainability--being capable of perpetuating itself and resilient to natural disturbances; (2) invasibility--demonstrated ability to resist invasion by new species: (3) productivity--demonstrated ability to support plant and animal populations at similar levels of productivity to pre-disturbance conditions; (4) nutrient retention and transformation--demonstrated nutrient processing and cycling to support microbial, plant and animal communities; and (5) biotic interactions--being capable of providing food chain support and maintaining local gene pools. A long-term monitoring process or assessment program is required to ensure the establishment and continuation of the restored structure and functional value and, more importantly, to evaluate the need for mid-course corrections in restoration methodologies.

2. Does NOAA plan to authorize the "steam cleaning" method used in Prince William Sound for future beach restorations following oil spills? If not, why not? What is your preferred type of clean-up methods - booms and skimmers, dispersants, or burning? Have you explored the use of sand washers similar to those the French employ?

There are a suite of techniques available to the Federal On-Scene Coordinator and the Scientific Support Coordinator to cleanup or mitigate the effects from an oil spill. Each spill has specific characteristics that requires on-site decisions regarding the most effective, yet least damaging, method of cleanup. The selection of the most appropriate techniques is affected by the characteristics of the oil which change over time, the location--water or shoreline, the ready access to sufficient equipment and supporting logistics, the environmental effects of the technique, the potential effectiveness of the procedure, and many other factors. Only through experience, training, documentation of spill activities, and long-term studies regarding the recovery of an area following application of different cleanup methods can wise selection of effective cleanup strategies be developed.

Steam cleaning may still be a preferred cleanup technique for very specific areas like piers and shoreline retaining walls although it should not be used for more sensitive environments. Both dispersants and in-situ burning are effective only if applied very quickly following the initial spill, and then only under certain circumstances. Bioremediation, although still in the research phase, is likely to be effective under very specific situations.

We are not specifically familiar with the French sand washer but have observed several systems that perform in a similar manner. These systems do a good job in removing surface oil from sand beaches but have limited application. Generally oil on sand beaches is not as significant an environmental problem as other oiled shorelines. There will continue to be applications for this type of technology, especially on beaches with high recreational use.

3. During the damage assessment phase of oil spill clean-up, you collect data to use: (1) in planning further clean-up and restoration, and (2) in assessing overall damage for subsequent litigation.

From the Exxon Valdez experience, it's clear that these two objectives are often in conflict. You may need to make this data widely available to facilitate clean-up and restoration, but the wide distribution of this same information may not be wise from the standpoint of litigation.

How can this problem be corrected?

We recognize the potential conflicts between the damage assessment process and the cleanup and mitigation activities. We have had several discussions with the Department of Justice on this issue, as well as with the U.S. Coast Guard who is equally sensitive to this issue. Although we have not yet defined the guidelines for allowing both activities to be fully carried out, we believe that such a solution is possible. The Department of Justice has been asked to provide guidelines for the release of damage assessment data.

4. At present, we know very little about the long term effects of oil spills on marine environments. Is any long-term monitoring being carried out? If not, what resources would be needed to initiate and carry out this monitoring?

Historically, there have been few long term monitoring programs on oil spill effects. When monitoring is done, it is generally related to cleanup effectiveness. These studies typically terminate within one to two years. Usually they do not use a standard set of protocols nor include sufficient statistical rigor to provide an adequate baseline to make sound predictions. The majority of data currently used for projecting long term effects is based upon laboratory studies; however, It is quite difficult to extrapolate laboratory results to the more complex, natural environment.

NOAA is currently continuing its summer monitoring program in Prince William Sound, with support from other agencies, and hopes to continue this for the next 3-5 years, provided sufficient funding is available. An additional study has been undertaken in the last six months in Fidalgo Bay, Washington, looking at the long term recovery and oil effects of a cleaned and uncleaned marsh.

Typically at the end of a significant spill response, there is a dramatic loss of public interest which results in an inability to obtain funds for longer term studies. Consideration needs to be given to a funding mechanism that allows for selected spills to be studied over the long term.

NOAA has been given the lead under OPA to develop a monitoring program for studying the effects of oil. Within existing resources, we have begun evaluating present information to define priorities for data gaps and areas where this information could best be collected. In addition, all restoration programs undertaken by NOAA with funds recovered for injury to natural resources will have a monitoring component.

The range of resources required to conduct a long term monitoring program depends upon the number of spills selected to study on an annual basis as well as the size and areal coverage of the spill's impact. Two current examples of long term monitoring programs show the range of costs that such monitoring may entail: Exxon Valdez (10.9 million gallons spilled) monitoring, logistics, and documentation - $ 750 K/year for 3 years; Fidalgo Bay (10,000 gal. spilled)- $100K/year.

5. Has any research been done on oil spill cleanup and restoration in freshwater systems, particularly the Great Lakes? What about cleanup and restoration in rivers?

Little research has been conducted on oil spill clean-up methods for freshwater systems, including the Great Lakes or rivers. Mechanical methods have been used primarily due to concerns about freshwater used as a drinking water source. These methods have been derived from marine spill experience; however, these experiences do not consider differences in freshwater habitat or hydrology. The Canadian government and industry have performed some research into the use of mechanical methods and additives in freshwater; however they acknowledge a need for additional research.

The state of knowledge for restoration of fresh water environments following oil spills is similarly dependent upon experience from coastal and marine environments. Research has been proposed under the research title of OPA to begin addressing some of the critical questions relating to restoring these environments.

6. One aspect of improving oil spill response effectiveness involved identification of environmentally sensitive areas. How is this being accomplished and on what scale?

For the last 10-12 years, NOAA has been involved in developing environmentally sensitive index (ESI) maps for the coastline of the U.S. These projects, although primarily funded by NOAA, have also included funds from the U.S. Coast Guard and various state organizations. The maps are compiled from a variety of sources, both Federal, state and local. To date, the majority of the U.S. coastline has been mapped, with the exception of small sections of the coast of Alaska, California and parts of the Great Lakes. Monies have been obtained to complete those portions of Alaska and California by the end of 1992. The Great Lakes is a larger effort which is presently being funded by the U.S. Coast Guard through NOAA. However, the completion of this effort depends upon the availability of funds.

6

Due to the EXXON VALDEZ and the resulting Oil Pollution Act of 1990, there is renewed interest by a variety of organizations to update or create new ESI-type products. NOAA is trying to work with these organizations to develop a prototype mapping standard so that these efforts can be coordinated to generate new and improved mapping capabilities for response planning.

Question from Mr. Goss

1. Are the Federal agencies aware of any private commercial efforts to develop oil-eating microorganisms? If so, are these efforts being explored and used by the Federal government? Please provide examples.

Yes, we are aware that there are many products being developed. We routinely have vendors contact us about these products. However, technical evaluation of these products is not NOAA's responsibility. Vendors are referred to the Environmental Protection Agency, the agency responsible for evaluating these products. NOAA does provide recommendations to the U.S. Coast Guard regarding the consequences of the use of these products and does, when necessary, monitor the use of products when applied during spill situations.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 13 1991

OFFICE OF CONGRESSIONAL
AND LEGISLATIVE AFFAIRS

Honorable Dennis M. Hertel
Chairman
Subcommittee on Oceanography, Great Lakes,
and the Outer Continental Shelf
Committee on Merchant Marine and Fisheries
House of Representatives
Washington, D.C. 20515-6230

Dear Mr. Chairman:

This letter is in response to your letter of July 1, 1991 requesting additional information to be added to the record of the June 18, 1991 hearing before the Subcommittee on Oceanography, Great Lakes, and the Outer Continental Shelf on the state of technology in oil spill cleanup.

Enclosed please find our responses to your specific questions. We are also enclosing our response to a question from Congressman Herbert H. Bateman that was directed to all the panel members at the time of the hearing.

If I can be of further assistance, please let me know.

Sincerely,

Thomas A. Roberts

Tom Roberts
Director
Legislative Analysis Division

Enclosures

cc: Honorable Herbert H. Bateman

Printed on Recycled Paper

EPA's RESPONSES TO FOLLOW-UP QUESTIONS FROM JUNE 18, 1991 HEARING ON OIL SPILL CLEANUP

1. Does genetic engineering offer potential for developing strains of bacteria that are far more effective in breaking down spilled oil? Would such bacteria pose any threat to marine environments?

   There has not been any work done on the use of genetically engineered organisms for use in bioremediation of oil spills by the Environmental Protection Agency (EPA) nor has any such effort been reported in the literature. Our experience to date indicates that naturally-occurring organisms, supplemented by nutrients where necessary, are capable of degrading oil. Before genetically engineered organisms are used for this purpose a complete assessment of risks to human health and ecological systems is needed.

2. Mr. Lindsey, I am alarmed in reading that clean-up efforts typically recover only 10 to 15 percent of spilled oil. For Prince William Sound, in the first year only 714,000 of the estimated 11 million gallons of spilled oil were recovered. What is the impact of unrecovered oil on the environment over the long term?

   Although a large percentage of the oil spilled into Prince William Sound was not recovered, we know that much of this oil either evaporated, was deposited onto the beaches and shoreline where it was later removed by a variety of techniques, or was dispersed over a wide area and highly diluted. The long-term effects of the oil which remains on the beaches and which became dispersed throughout the water column are being studied by the State and Federal Natural Resource Trustee Agencies. The Fish and Wildlife Service is studying the effects of the oil which became dispersed throughout the water column on the marine food chain.

3. You mentioned that we presently have no available technology for oil spill clean-up in fast moving, turbulent streams. Should oil development, extraction, and transport be stringently restricted in, and around such environments?

   The fast moving bodies of water referred to are inland rivers and large streams. These are not bodies of water where oil development or extraction has normally occurred. As far as transportation of oil is concerned, there are many cases where pipelines cross such rivers and streams and where barges are used to transport oil on these rivers. It would not be feasible to restrict such movement of oil. The Oil Pollution Act of 1990 requires the Agency to re-evaluate the contingency plans for non-transportation related oil handling facilities and for the Coast Guard to do the same for transportation related facilities. When implemented, these plans should reduce the risk for major spills from these

facilities. EPA is conducting research to develop improved containment and removal technologies for these bodies of water. When completed, in about three years, we should be in a better position to cope with a spill in a fast flowing stream.

4. Are the federal agencies aware of any private commercial efforts to develop oil-eating microorganisms? If so, are these efforts being explored and used by the federal government? Please provide examples.

The Environmental Protection Agency has been working closely with the private sector in the development of bioremediation agents for use on oil spills. Shortly after the Alaskan spill we convened a panel of experts from industry, academia and government to advise us on the best approach to assure that developments by the private sector could be utilized quickly. To do this, we are developing a series of protocols for verifying the efficacy and toxicity claims made by the developers of these products. These protocols are being developed by the National Environmental Technology Applications Corporation (NETAC) utilizing an advisory panel from government, industry and academia. We have solicited manufacturers of these products to participate in the verification of these protocols by submitting information about their products. Once testing is completed, the information on the products tested will be made available to the Regional personnel who must decide on the best clean-up technique to apply to any given spill situation. A preliminary version of these protocols was used to select commercial products for further testing in Alaska last summer. Of the approximately 40 products submitted in response to a request for proposals, 12 were selected for further testing according to the protocols and two were finally selected for further testing in Alaska. The results of these tests will be available in the near future.

EPA's RESPONSE TO QUESTION FROM CONGRESSMAN HERBERT H. BATEMAN ARISING FROM JUNE 18, 1991 HEARING ON OIL SPILL CLEANUP

Q. Please provide for the record the FY'92 oil spill R&D budget and an identification of what work will be done.

A. The FY'92 appropriation for oil spill research in the President's budget is $2,5OOK which includes $2,475K for extramural R&D. An additional $25K is budgeted for expenses for scientific personnel associated with this activitiy. Extramural funds will be spent as follows:

(1) Bioremediation basic research, field demonstration and protocol development (see pp. 4 and 5 of Testimony attached) $2,222K

(2) Dispersant protocol development (p. 6 of Testimony) $ 153K

(3) Debris disposal (pp. 6 and 7) $ 100K

We are currently in the preliminary stages of reviewing past work and future planning related to technology in removing oil from fast moving streams (p. 6 of Testimony).

United States Department of the Interior

MINERALS MANAGEMENT SERVICE
WASHINGTON, DC 20240

JUL 25 [redacted]

Honorable Dennis M. Hertel
Chairman, Subcommittee on Oceanography,
Great Lakes and Outer Continental Shelf
Committee on Merchant Marine and Fisheries
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

As a follow-up to the June 18, 1991, hearing on the state of technology in oil spill cleanup and response measures, we were asked to respond to additional questions for the record.

Enclosed are the responses to your questions. We appreciate the opportunity to testify before your Subcommittee and look forward to working with you on issues of mutual interest. If there are any questions regarding any of the information contained in the enclosure, please contact the Minerals Management Service, Office of Congressional and Legislative Affairs on (202) 208-3502.

Sincerely,

Jennifer A. Salisbury
Acting Director

Enclosure

cc: Honorable Herbert Bateman
Ranking Minority Member, Subcommittee
on Oceanography, Great Lakes, and Outer
Continental Shelf
Committee on Merchant Marine and Fisheries
Washington, D.C. 20515

Question 1: **In your written testimony, you mentioned the development of the use of shipboard navigational radar to detect and track open-ocean oil spills. How effective is this technique? Are you doing any cooperative studies with the Navy on this?**

Answer 1: The technique has proven successful in detecting and tracking spills as small as 5 barrels (210 gallons) out to a distance of 12 nautical miles. The strategy was successful in a range of wind speeds from less than 10 to more than 30 knots. The slicks rapidly dissipated at these higher wind speeds. The technique has been used successfully on three at-sea oil spills. The U.S. Navy is aware of this Minerals Management Service (MMS) research through continuing interagency meetings, the issuance of a patent, and through scientific literature. However, the U.S. Navy has expressed no interest, at this time, in cooperating with planned MMS research to improve the technique.

Question 2: **Mr. Tennyson, you cite a $1 million increase in the President's 1992 budget request for MMS oil spill research. This increase is intended to make up for termination of the $1 million in funding previously provided by the American Petroleum Institute (API). Why has API terminated its support of your research?**

Answer 2: The API has not "terminated" its support of the MMS oil spill response research program. The original agreement was for API to provide $1 million per year for 3 years beginning in 1989. The agreement has been honored to date. The API has indicated in recent meetings that it no longer will be involved in research pertaining to marine oil spills beyond 1991. They have stated that their research activities will be shifted to the newly formed Marine Spill Response Corporation (MSRC). The MMS has held several meetings with the MSRC to explore the possibilities of cooperative support for research. The extent of MSRC cooperative support, if any, is undetermined at this time.

Question 3: What are the advantages and disadvantages to burning spilled oil?

Answer 3:

The major advantage of in-situ (in place) burning of spilled oil is that 90 percent or more of the oil can be removed from the surface of the water, leaving a heavy and essentially nontoxic residue. This compares very favorably with mechanical containment and cleanup. As long as the oil slick thickness exceeds 3mm, the oil can be burned without artificial containment. Broken ice serves as a natural container inhibiting the spreading of oil. Therefore, high oil removal capabilities can be expected in ice fields where other removal strategies would be unfeasible. Oil can be collected in fire-resistant booms for thinner slicks and burned.

The MMS has spent the majority of its research funds since 1985 on evaluating the airborne pollutant loading and behavior of burning oil. Results from an extensive series of tests indicate that pollutants such as dioxins, furans, PAH's and PNAH's are not created by the burning process. These pollutants, which are contained in the spilled oil, are partially destroyed or modified to less toxic compounds by burning. A large portion of these compounds would be released into the air and water through evaporation and dissolution in their original and more toxic forms if burning does not take place. Recently completed tests of open air burning at Little Sands Island, Mobile, Alabama, and other large burns suggest that concentrations of airborne pollutants from the sizes of fires we are envisioning reach the lower limits of detection within 1 to 3 miles from the burn, even though the smoke and soot may be visible for several times that distance.

The appearance of smoke in large quantities generates understandable health concerns from observers, even though the smoke is usually lifted higher and dispersed more thoroughly than is the case for the lighter ends evaporating in more toxic forms and concentrations from the unburned slick. Additional concerns about burning revolve around safety of resources to be protected and the health and safety of the spill responders and the source of the spill. Endangering a tanker or platform that still contained the majority of the cargo or storage capacity, such as the case of the Exxon Valdez, must be considered on a case by case basis.

The quantity and the chemical and physical properties of the residue created by burning spilled oil strongly indicate that the toxicity, viscosity and adhesive properties will be far less damaging to the biota than the unburned oil after weathering and emulsification have taken place. Burning does not create toxic compounds which are not in the parent oil.

Another major benefit of in-situ burning is that the more weathered the oil , as long as high rates of emulsification have not occurred, the more efficient the burn that can be expected. This allows burns to continue beyond the time that use of dispersants would be considered effective.

Overall, we believe that in-situ burning is one of the more promising response strategies and that it clearly merits field verification at accidental or planned experimental spills. We consider that in-situ burning can be a "first response" option, on a case-by-case basis, along with mechanical containment and cleanup and the use of dispersants.

Question 4: **Are the Federal agencies aware of any private commercial efforts to develop oil-eating micro-organisms? If so, are these efforts being explored and used by the Federal government? Please provide examples.**

Answer 4: MMS is aware of several private commercial efforts to promote the use of oil-eating micro-organisms for oil spill response. The MMS participated in a workshop convened by the Office of Technology Assessment late in 1990 to evaluate attempts to accelerate natural weathering of spilled oil by introducing nutrients and/or oil-eating micro-organisms. The MMS is working with Environment Canada to develop test procedures to evaluate the effectiveness of these techniques in the laboratory.

The Environmental Protection Agency (EPA) has the lead on research on bioremediation. This action has been taken pursuant to agreements reached in the Interagency Research Committee established by the Oil Pollution Act of 1990. Therefore, the MMS will defer to the EPA for a more detailed response on this particular issue.