# OCEANOGRAPHY MISCELLANEOUS—PART 2

## HEARINGS

BEFORE THE

## SUBCOMMITTEE ON OCEANOGRAPHY

OF THE

## COMMITTEE ON MERCHANT MARINE AND FISHERIES HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

ON

OCEAN BIOMASS CONVERSION OVERSIGHT
SEPTEMBER 26, 1979

OCEAN POLLUTION PLANNING AUTHORIZATION AND OVERSIGHT—H.R. 6615
FEBRUARY 29, 1980

OUTER CONTINENTAL SHELF DRILLING ACTIVITIES OVERSIGHT
AUGUST 26, 1980

OCEAN ENERGY OVERSIGHT
SEPTEMBER 25, 1980

RADIOACTIVE WASTE DISPOSAL OVERSIGHT
NOVEMBER 20, 1980

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[3] Resigned March 10, 1980.
[4] Elected to committee March 10, 1980.

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## OCEAN POLLUTION PLANNING AUTHORIZATION AND OVERSIGHT

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# OCEAN BIOMASS CONVERSION OVERSIGHT

WEDNESDAY, SEPTEMBER 26, 1979

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
*Washington, D.C.*

The subcommittee met, pursuant to notice, at 10:45 a.m., in room 1334, Longworth House Office Building, Hon. Gerry E. Studds, chairman, presiding.

Present: Representatives Studds, AuCoin, Hughes, Forsythe, Pritchard, and Emery.

Staff present: Rich Norling, Don Lippincott, Diane Hull, Ann Land, and Curt Marshall.

Mr. STUDDS. I understand the "Joint Chiefs" have made a graceful retreat. The room is now ours.

The subcommittee will come to order.

Today marks our third hearing on renewable sources of energy from the ocean. In past hearings, we have dealt with ocean thermal energy conversion, a process which utilizes the temperature difference between warm surface waters and cold subsurface waters to produce electricity. Today we will focus on ocean biomass conversion, a process which is designed to convert seaweed into methane gas.

Most Americans regard seaweed as simply a nuisance—who said that? Speaking as someone who spent a large part of his youth gathering seaweed, I think I will disregard those remarks.

Few of us realize that it has been commercially harvested off the U.S. coast since the 1930's for use as a food additive and animal feed supplement. Fewer still realize that seaweed could be used to produce energy and that there could be a giant seaweed gasification industry off our coasts before the year 2000.

Ocean biomass conversion is a process by which the solar energy stored in a plant—like seaweed—is converted into a gaseous product. The most likely method would be a process called anaerobic digestion, which utilizes bacteria in an oxygen-free atmosphere to convert waste materials into methane, a colorless, odorless gas, already widely used as a substitute for natural gas. This process would be somewhat like land-based biomass conversion which produces methane gas from useless garbage. Land biomass energy conversion already fulfills a small, but growing portion of U.S. energy demands and researchers believe ocean biomass energy could one day provide double or triple the amount that land can produce. The major difference is that commercial ocean biomass conversion has not yet become a reality.

Since the harvesting of seaweed as a food source has been going on for nearly 50 years, no new technological breakthroughs are needed to bring this about. However, ocean "farms" of over 100 square miles might be necessary if we are to make cultivation for energy purposes economically feasible. Obviously, this would create a great many siting and space-use conflicts—issues we intend to delve into today.

The major ongoing research and development project for ocean biomass conversion is now being conducted by the Gas Research Institute (GRI), a nonprofit scientific research organization, in conjunction with the Department of Energy. Thus far, their work has focused on the energy potential of a large brown seaweed called California giant kelp, one of the fastest growing plants in the world. We will hear today about their progress as well as about some of the problems they have encountered.

We will also hear from others who have successfully experimented with methods other than those employed by GRI, and with seaweeds other than California giant kelp.

Important questions about methodology and about the nutrient needs, diseases, and growing habits of seaweed will have to be answered before the cultivation of seaweed for energy production can reach a significant level.

Until these issues are resolved, the role which ocean biomass conversion may one day play in our energy future will remain highly speculative. However, it is clear that this form of energy does have a great deal of potential, especially since the technology needed for a major commercialization is already developed.

Given our dwindling energy supplies and increasing dependence upon foreign sources of fuel, we as a nation cannot afford to investigate alternative energy sources in as plodding and methodical a fashion as we could 10 or 20 years ago. The major purpose of our hearings today—and those we have already held on ocean energy—has not only been to investigate the feasibility and potential of these emerging technologies, but also to encourage DOE to hasten the development of those which appear the most promising. Our research to this point indicates that ocean biomass conversion may deserve a boost from the Federal Government.

I would just warn the witnesses that the House is in session. We will undoubtedly be interrupted by a series of votes as the House attempts to undo what most of us have been doing.

Our first witness is Mr. Martin R. Adams, Deputy Program Director, Solar and Geothermal Energy, Department of Energy.

## STATEMENT OF MARTIN R. ADAMS, DEPUTY PROGRAM DIRECTOR, SOLAR AND GEOTHERMAL ENERGY, DEPARTMENT OF ENERGY, ACCOMPANIED BY DR. ROBERT L. SAN MARTIN, DIRECTOR, DIVISION OF DISTRIBUTED SOLAR TECHNOLOGY

Mr. ADAMS. Thank you, Mr. Chairman. Accompanying me today is Dr. Robert San Martin, who is the Director of the Distributed Solar Division, under my direction, whose activities also include the entire biomass area.

If it is agreeable with you, sir, I would like to make summary comments, and submit for the record my detailed statement.

Mr. STUDDS. Your statement will appear in the record in its entirety.

[The following was received for the record:]

STATEMENT OF MARTIN R. ADAMS, DEPUTY PROGRAM DIRECTOR FOR SOLAR, GEOTHERMAL, ELECTRIC AND STORAGE SYSTEMS, ASSISTANT SECRETARY FOR ENERGY TECHNOLOGY

Mr. Chairman and Members of the Subcommittee, I am pleased to be here today to discuss the Biomass Energy Systems program of the Department of Energy with particular emphasis on the aquatic biomass component of the program.

Biomass is a term we use to describe organic material used for energy; the term includes animal wastes and plants, both terrestrial and aquatic. Biomass can be burned directly to produce heat energy or it can be converted to fuels which replace petroleum and natural gas. In 1977 about 1.8 Quads/yr or 2.4 percent of the United States' energy supplies were obtained from biomass sources. This is primarily from direct combustion of wood wastes in the forest products industry.

The potential United Sttes biomass resource base has been estimated to be as large as 10 to 15 Quads/yr on a sustainable basis. This would include forestry residues and wastes, agricultural residues and wastes, and crops, grown for their energy value. This places biomass as a significant energy resource for the future. The Domestic Policy Review (DPR) of Solar Energy, and other studies, have estimated 1985 levels of biomass usage in the range of 2.6 Quads and a total of 3–7 Quads/yr are estimated by 2000. This makes biomass potentially the single most important renewable solar energy contributor between now and 2000.

It is this exciting potential that has led to an increased emphasis on biomass energy within the Department of Energy during the past few years. As an example, the budget of the Biomass Energy Systems program increased by a factor of 13 in just three years, from $4.5 M in fiscal year 1976 to $58 M in fiscal year 1980.

The biomass program objective is to develop biomass resources and related conversion technologies for displacing U.S. use of petroleum and natural gas. In pursuit of this objective the program has established four major lines of activity:

To perform research and development of innovative systems;

To develop production techniques to increase the resource base of biomass and decrease biomass feedstock costs;

To develop bioconversion systems such as fermentation to make alcohol and anaerobic digestion to produce gas and by-products; and

To develop thermochemical conversion processes which produce petroleum substitutes such as heavy oils. This work also includes direct combustion of wood, to produce heat for steam and for electricity production.

During the next two decades, wood and agricultural crops, residues and wastes will provide the vast majority of this biomass material. However, as demand for biomass resources increases, there will be increased competition for prime forest and farm land to produce higher value products such as lumber, paper and food crops. Increased competition for land, as well as fresh water to irrigate the land may well be the limit on the ability of biomass to contribute to U.S. energy needs. In such a circumstance, alternative sources of biomass such as the ocean as well as ponds, swamps, and other bodies of water will look increasingly more attractive as biomass resource areas.

Aquatic biomass resources offer the long-term potential for supplying large portions of U.S. energy demands. Aquatic biomass involves both marine or ocean-based, and terrestrial or land-based biomass production. Land-based aquatic biomass might include freshwater production as well as biomass growth in saltwater or brackish water. Much of the land-based aquatic biomass could be grown on marginal land, not suitable to traditional forestry or agricultural use. An example of this is the work being done by private industry on the growing of algae in brackish water ponds in the Southwest.

We estimate that, before the year 2000, aquatic biomass, based on continental and ocean production could contribute up to 1 Quad/yr of additional alternate fuel and, in the next century, 3 or 4 Quads/yr. We cannot now closely estimate whether land-based or ocean systems will make up the larger part of this amount. While the ocean potential is large, so too is that of land-based aquatic systems.

Whatever the form of the aquatic biomass, the key to achieving this potential lies in developing high-yield species and in developing cost-effective growing and harvesting techniques. Our best present estimates for potential yields are in the neighborhood of 25–30 dry ash-free tons/acre/year for marine biomass and, perhaps as much as five to six times that for some land-based aquatic biomass. These figures

compare favorably with 8 to 12 dry tons/acre/year for fast-growing trees and 27 dry tons/acre/year yields for sugar cane, among the most efficient terrestrial plants.

Another way to represent these high yields is to note that it would take approximately 2.6 million acres of ocean to grow 1 Quad of marine biomass. This means that an ocean area of 250,000 square miles or 7 percent of the area of the U.S. could conceivably some day provide energy equivalent to the current energy needs of the United States.

With this background, I would like to turn briefly to a discussion of the current DOE aquatic biomass program. The program has two major objectives:

To identify aquatic plants with good energy potential and determine the nature of these plants and their cultivation potential;

To develop techniques for their economic cultivation and their conversion to fuels.

The thrust of the aquatic biomass program is toward developing systems which use algae. This class of plants ranges from macroalgae like the giant kelps (*Macrociptis pyrifera*) which can reach over 100 feet in length in the ocean and grow at up to 2 feet/day to microalgae which are microscopic plants common to fresh or brackish water. We have focussed on algae because they have such high yields. For example, a freshwater algae farm could produce about nine times as much energy as an equal area devoted to corn per year. Further, algae can be converted relatively easily to methane, alcohol and other useful products such as chemical stabilizers, food additives and protein supplements for animal feeds.

DOE is actively studying the potential for algae cultivation and yield improvement. Natural growth of ocean algae provides about 5 tons of dry ash-free kelp per acre. In contrast, recent DOE studies have concluded that there is a potential for yields of 25–30 dry ash-free tons per acre per year. In New Mexico, experimental results have shown yields of as much as 150 dry ash-free tons per acre per year under natural solar insolation. Other results by General Electric and Dow Chemical show similarly promising results. Indeed, a major need which our program is trying to satisfy is to determine these yields more accurately and to better define the conditions that foster higher yields and growth rates.

One important DOE project in algae is the work on giant kelp by Dr. Wheeler North of the California Institute of Technology. This kelp is a fast growing marine plant with a wide geographic range (from Chile to Peru and from Mid-Mexico to Alaska), the kelp is large and can be harvested on a practical basis, it is naturally nourished but yields can be improved by increasing nutrient supplies; it has relatively high conversion rate from raw material to methane gas and it is self renewing.

The Gas Research Institute-General Electric work in collaboration with Dr. North of Cal Tech is addressing the problem of large-scale marine cultivation and yield. Dr. Flowers has described to you how an engineered module can direct nutrients to the plants and result in improved poroductivity. This work is important in establishing an information base for the large-scale growth of marine biomass.

At present, a quarter-acre biological test farm is deployed off the California coast. The Department of Energy is funding this effort jointly with the Gas Research Institute (GRI) and to date $6.8 million has been invested. We plan to spend an additional $3.5 million in fiscal year 1980 to obtain the information necessary to verify biomass yield and cost projections as well as the capacity of such farms to poroduce a net gain in useful energy.

Whether or not this initial attempt at open ocean farming proves successful, we will have learned valuable lessons about the difficulties and costs of working in this sometimes hostile environment. The opportunities and prospects of utilizing the open seas are simply too numerous and important to ignore. There is certainly risk involved before we can be sure that marine biomass will prove to be a viable answer, but we regard the main objective of this work to be information gathering.

A complementary concept to open ocean farming is to use seawater for growing marine or brackish-water biomass within land-based facilities. Such systems would make productive use of otherwise non-arable lands, avoid many of the engineering challenges offered by the open sea, and permit an opportunity to develop more information about the fundamental requirements of marine biomass energy production and conversion.

An example of this approach is a new project to seek hydrocarbon products directly from algae. This has just gotten underway, co-funded by the Department of Energy and the State of Hawaii. The project is to prove the feasibility of culturing and using a micro-algae *Phaeodactylum tricormutum)* which has the quality of producing and storing oils. Tests so far have achieved concentrations of between 40 and 70% of oils to total organic yield from the harvested algae.

Other aquatic biomass production studies are being done for the Department of Energy at the Woods Hole Oceangraphic Institute where both ocean and freshwater

algae are being studied to uncover their photosynthetic qualities in order to identify high yield species. We are also studying the large scale cultivation of selected algae species under controlled conditions for energy farms composed of converted natural ponds and man-made lagoons, where very high productivity rates can provide raw material for direct conversion to energy products. We are also working on harvest and collection projects for water hyacinth plants as a natural source of aquatic biomass for gas and alcohol production.

To give value to this work, it is not sufficient to produce the biomass, but it has to be converted to useful energy forms. Therefore, parallel to the efforts involved in the production effort are investigations in conversion. The technologies applied to terrestrial biomass can generally be applied to the aquatic biomass, modified to fit the aquatic nature of the material. Indeed, the bulk of the funds in the overall biomass energy program are directed to development of these conversion technologies.

One can divide conversion technologies broadly into thermochemical approaches, which rely on high temperatures and pressures to convert the biomass to fuel products, and biochemical approaches, which utilize bacterial action. Because of the nature of aquatic biomass, and particularly its highwater content, the biochemical conversion technologies of fermentation and anaerobic digestion are most suitable.

As Dr. Flowers has discussed, General Electric and the Institute of Gas Technology are giving specific attention to the problem of anaerobically digesting giant kelp to produce methane. We also have a project at the University of California on the large scale bio-conversion of algae which has importance for pollution control of urban wastes.

The aquatic biomass program is administered by the Biomass Energy Systems Branch of the Division of Distributed Solar Technology within the Department of Energy. A breakdown of the fiscal year 1979 biomass budget is shown in Figure 1. The budget for production and conversion of aquatic biomass has been growing rapidly as seen in Figure 2. We expect this trend to continue. In fiscal year 1980, about six million dollars, or more than 10% of the entire biomass program budget, is budgeted for aquatic biomass. For your information, Figure 3 contains a list of aquatic biomass contracts whch have been funded in the program.

I would like to conclude my remarks with a few comments regarding the issues associated with the use of aquatic biomass for energy. Obviously, we regard aquatic biomass as having high potential for making a significant contribution ultimately to the energy supply of our Nation. The vast areas of the ocean, as well as suitable marginal lands as in the U.S. Southwest, could lend themselves to very large-scale aquatic biomass farming. This, coupled with the very high yields which seem to be possible from algae, could lead to highly productive enterprises.

The key issue we are now facing is lack of information. We clearly know vastly more about growing and harvesting corn than about growing and harvesting algae. That is why I see the main product of this program over the next several years as being information. We must learn about the variety of plant species available, about their sensitivity to changes in growing conditions, and about the most efficient and economical ways to harvest and convert the biomass.

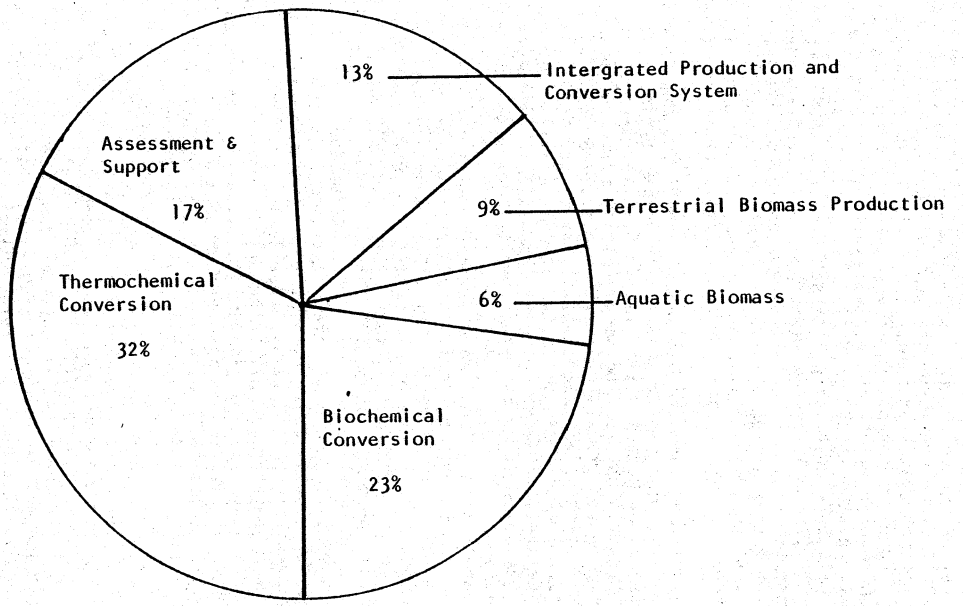
We have, for example, performed a number of studies on the economics of methane production from giant kelp farms. There are two basic findings—that the projected gas costs tend to be high compared to other sources of gas, and that the projections span a wide range depending on the assumptions made. We are not discouraged by these results because they are measures primarily of the extent to which we need information.

We are encouraged with what we have been learning about aquatic biomass. We remain optimistic about an ultimate ability to capture the benefits of open-ocean mariculture. We are also very excited about the potential for wide-spread aquaculture on marginal lands. Finally, we welcome your continued interest in the Administration's Biomass Program.

Thank you.

FIGURE I

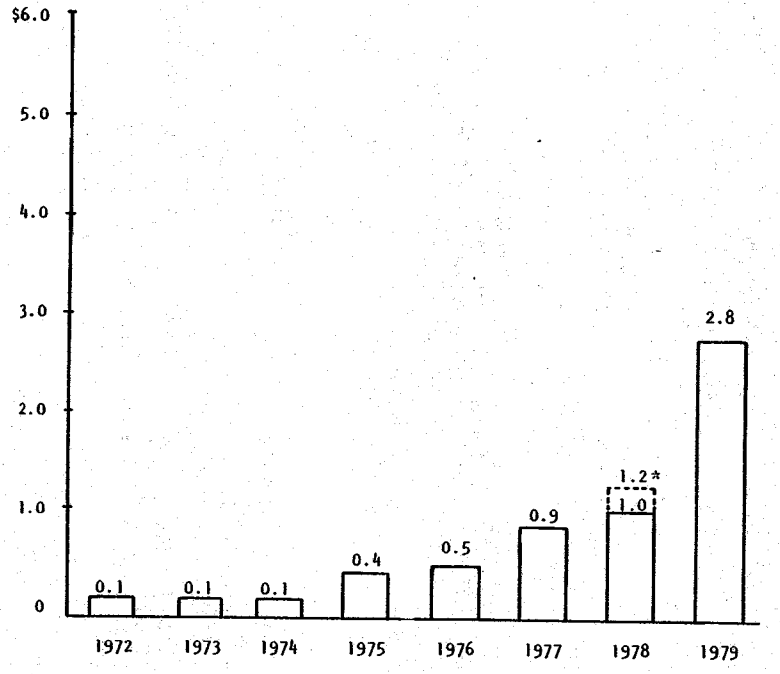
BIOMASS BUDGET - FY 1979




TOTAL FY 1979 FUNDING: $42.4 Million

FIGURE 2

AQUATIC BIOMASS FUNDING
($ in millions)




* Not from Biomass Program

Figure 3. A LISTING OF DOE AQUATIC BIOMASS FUNDING

Aquatic Biomass Funding

| | |
|---|---|
| 1972 | |
| University of Pa. "Conversion of Solar Energy to Fuel Gas" June 15, 1972 (Approximately ½ to "Mariculture Investigation: Ocean Farming and Fuel Production" at United Aircraft Research Laboratories, Hartford, Conn.) | $ 195,000 |
| 1973 | |
| Columbia University "Marine Pastures: A By-Product of Large 100 MW of Larger Floating Ocean Thermal Energy Plants" | 99,000 |
| University of California - Algal Systems to Produce Methane | 52,000 |
| 1974 | |
| Columbia University "Marine Pastures..." | 38,000 |
| Cal. Inst. of Tech. "Evaluation of Oceanic Farming of Seaweeds as Sources of Organics and Energy" | 110,000 |
| 1975 | |
| U.S. Navy "Ocean Energy Farm Kelp Production and Harvesting" | 410,000 |
| University of California "Large Scale Algal Biomass Production Systems" | 60,000 |
| Ocean Policy Committee | 5,000 |
| 1976 | |
| Cal. Tech. "Evaluation of Ocean Farming of Seaweeds as Sources of Organics and Energy." | 325,000 |
| University of California "Large Scale Algal Biomass Production Systems" | 157,000 |
| Woods Hole-Ryther "Cultivation of Macroscopic Marine Algae for Energy Conversion..." | 195,000 |
| Woods Hole-Goldman "Photosynthetic Systems-State of the Art and Potential for Energy Production" | 26,000 |
| 1977 | |
| Cal Tech. "Evaluation of Ocean Farming of Seaweeds as Sources of Organics and Energy." | 578,000 |
| University of California - "Large-Scale Algae Biomass Systems" | 60,000 |
| Intertechnology/University of California Photosynthetic Energy Factory | 226,000 |
| Columbia University "Algal Concentration by Ultra-Filtration" | 88,000 |
| Woods Hole-Ryther "Cultivation of Macroscopic Marine Algae" | 206,000 |
| Woods Hole-Gol Dynatech-System Study "Cost Analysis of Aquatic Biomass Systems" | 149,000 |
| 1978 | |
| Cal Tech. (Partial Funding July to October only) | 371,000 |
| Woods Hole-Ryther "Cultivation of Macroscopic Marine Algae for Energy Conversion" | 223,000 |
| Woods Hole-Goldman "Bioengineering Aspects of Inorganic Carbon Supply to Mass Cultures" | 79,000 |
| Dynatech "Cost Analysis of Aquatic Biomass Systems" | 45,000 |
| Dynatech "Liquid Fuels from Marine Algae" | 227,000 |
| University of California - "Large-Scale Algae Systems" | 154,000 |
| Intertechnology/University of California Photosynthetic Energy Factory | 231,000 |
| 1979 | |
| Cal. Tech | 512,000 |
| Woods Hole-Ryther | 252,000 |
| Woods Hole-Goldman | 95,000 |
| Dynatech Liquid Fuels | 252,000 |
| Univ. of California, Berkeley "Large Scale Fresh Water Microalgae Biomass Production for Fuel and Fertilizer" | 195,000 |

Mr. ADAMS. I am pleased to be here today to discuss DOE's biomass program, with emphasis on the aquatic complement. We define biomass as organic material that is used for energy. The organic material can either be burned directly, or it can be converted to gas or liquid products, for fuels, or for feedstocks.

In 1977, the Nation used in the order of 1.8 quads of biomass material. Already a significant contribution to our national energy supplies, amounting to about 2.4 percent of our total supplies. Most of this was in the form of direct combustion of wood.

Mr. STUDDS. How much of that was in wood burning?

Mr. ADAMS. I do not have a precise figure, but I believe practically all of it was in direct wood burning.

[The following was submitted:]

ENERGY PROJECTED FROM WOOD BURNING IN 1985

Direct combustion, pyrolysis, and gasification of wood are expected to provide about 2 quads of energy out of a total of about 3 quads expected from biomass sources by that date. Direct combustion will contribute the largest quantities of energy in the form of industrial and residential heat and co-generated electricity. Most of the energy is expected to be produced and consumed by the forest products and paper and pulp industries.

Mr. STUDDS. So you consider the generation of heat by wood-burning stoves to be biomass?

Mr. ADAMS. Yes, sir.

Now, the administration recently conducted a domestic policy review of solar energy, and that policy review, together with other studies, indicates a very important future contribution to the Nation from biomass.

In 1985, the estimated numbers are in the range of 2½ to 3 quads of biomass contribution, and in the year 2000, in the range of 4 to 7 quads of biomass energy contribution.

Mr. STUDDS. May I interrupt you?

How much energy is projected from wood burning in 1985?

Mr. ADAMS. Direct combustion, pyrolysis, and gasification of wood are expected to provide about 2 quads of energy out of a total of about 3 quads expected from biomass sources by that date. Direct combustion will contribute the largest quantities of energy in the form of industrial and residential heat and cogenerated electricity. Most of the energy is expected to be produced and consumed by the forest products and paper and pulp industries.

This total contribution makes biomass the largest potential contributor in this century from renewables. DOE is excited about this potential, and biomass research and development efforts have received increasing attention in the Department.

The biomass budget has grown about 13 times by a factor of 13 in the last 3 years, from $4.5 million in 1976 to $58 million in 1980.

Mr. STUDDS. What percentage is that of your research budget?

Mr. ADAMS. Approximately 10 percent.

Mr. STUDDS. Of the entire research budget of the Department of Energy?

Mr. ADAMS. No, sir, under my direction. Of the entire research budget, I will have to get you, again, a precise figure on that, but it would be in the order of three-tenths of 1 percent, I believe.

Mr. STUDDS. Thank you. That is just a prospective, in addition to the multiplication by 13?

Mr. ADAMS. Right. The biomass area has received increasing relative attention in the Department. In terms of our strategy, most of the large increase in biomass use in this century, we believe, according to our studies, will be by wood combustion. Primarily the burning of wood residues from forests, and from other sources.

There will be some contribution from alcohol. DOE recently completed an alcohol policy review, and there will be other biomass contributions in the forms of gases and liquid products. But the increasing need for liquid and gaseous hydrocarbon fuels, and feedstocks, combined with increasing competition for edible crops, and paper and building materials, et cetera, these factors in combination are driving us in the direction of research on sources of biomass that achieve the following goals.

Those sources that are dedicated for energy usage, in other words, they are not so highly competitive, those that exhibit maximum yields, and low cost, and/or amendable high conversion efficiencies to fuels, and that show favorable economics, and those feedstocks that maximize the effective use of space for their growth.

Now, successful R. & D. efforts in this area will lead us to new and more plentiful sources of biomass material. We feel that this could potentially greatly expand our usable sources of biomass.

Department estimates indicate that a sustainable level of biomass production in the Nation could be in the range of 10 to 15 quads per year, for forest growth, and this does not include, however, the growth of biomass on the oceans, or the more advanced methods of biomass production.

So when we begin to reach up into the 5- to 6- to 7-quad range, we begin to tap pretty heavily into that sustainable biomass production level.

This consideration drives us in the direction of looking for other advanced ways of producing biomass material. This is causing us to search, both terrestrially and in waters for ways to produce biomass.

Out of the $58 million included for biomass in our 1979 budget, 15 percent was for terrestrial and aquatic biomass. It is significant in this regard, that 9 of the 13 percent was terrestrial and 6 percent was aquatic.

In our 1980 biomass budget mix, this is growing to about 10 percent. The 6 percent for aquatic is growing to about 10 percent.

So the aquatic biomass source that we are dealing with constitutes both marine and fresh water systems, in open oceans and on land. It is still too close to call, and I will have some additional comments about this, about the respective contributions in the future out of these different sources.

I would like to stress that our aquatic work, both terrestrial and ocean, is research and development. It is aimed at finding sources of biomass supply for the longer term. We do not see this as the answer to the next energy problems in this year or in the next. But it is important, longer term research.

In our sense of priorities we would utilize first and earliest those biomass sources that we could tap quickest, and in the most ready and economic manner. Our work does not preclude, however,

breakthroughs that could bring aquatic biomass to fruition in early years. We are certainly open to that.

The present state of our knowledge about aquatic biomass is simply reflected by the wide range of estimates of yield and cost. There are tremendous uncertainties at the moment.

Just to give you some benchmarks for uncultured forest wood growth, the figure of less than a ton per acre per year, that is an oven dry ton of biomass growth is common. Under accelerated growing conditions we think we know how to increase that to the range of 7 to 12 tons per acre per year.

Corn producing 100 to 200 bushels per acre, just by comparison, would be in the range of 2 to 5, or over tons per acre per year.

Now, we have also examined the question of the theoretical maximum production of organic growing, organic material per acre, and the estimates there are all over the map. I have seen estimates that range all the way from 10 to in excess of 35 dry tons per acre per year.

For land-based water systems, biomass water systems, I have seen numbers that range up to several times that, as high as 150 or 180 dry tons per acre per year.

We hear about work in New Mexico, and we hear about work in South Africa, and work in Israel, and in other parts of the world that have achieved, on some experimental basis, what appear to be extraordinary high growth rates. Some of the theoretical estimates that we have seen for marine biomass would indicate maximum theoretical yields of 45 to 50, and in fresh water 60 to 70, 75, in that range. These wide ranges of uncertainty also give rise to tremendous ranges in costs.

The cost of producing biomass feedstock is a major part of the cost to the finished energy product. We see numbers that range anywhere from $20 to $30 per dry ton, to several hundred dollars per dry ton.

Now, by the research and development efforts that the Department of Energy is conducting, we would hope to be in a position in the early eighties, in 1982, 1983, to better judge the relative costs, and the various factors, quantitatively the various factors that are associated with producing marine and terrestrial biomass than we are now, and to narrow that uncertainty.

We believe that this is the essence of why it is important for us to do research both on land and in the ocean. Because we believe, first of all, that the potential for biomass is very large, and that the risks associated with ever achieving possible results are manageable, they are reasonable research risks, but the uncertainties likewise are very, very large at this time. So our research program is designed to narrow these uncertainties, and we are very early into the research, as far as being able to pin down priorities, and say yes, with certainty we believe that one particular kind of biomass can produce a lot more than another particular kind of biomass, and that the cost would be thus and so.

Our aquatic biomass program also fits into the spectrum of DOE's ocean energy program. Dr. Miller discussed the ocean thermal program with the committee not long ago. There are natural potential tie-ins between biomass production in the ocean and the ocean thermal program.

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The upwelling of nutrients, and the discharge of those nutrients nearer the surface into the ocean, as well, on the other side of the coin, the institutional factors involved with growing biomass in the ocean bear some resemblance to the institutional considerations of ocean thermal systems.

There are also some tie-ins with other aspects of the ocean program. In waves, for instance, just as it is quite possible to capture wave energy and utilize that in the form of electricity, it might be possible to utilize that electricity to lift water for supplying nutrients to the growing biomass.

However, there is also indication that it would be better to use the electricity for some other purpose. But there are natural tie-ins between the biomass program and our ocean thermal program.

Mr. STUDDS. You are at the assistant secretary level. You have ocean biomass responsibility, but you do not have ocean thermal responsibility over there, do you?

Mr. ADAMS. Yes, sir; we do.

Mr. STUDDS. You are also sitting on ocean thermal energy conversion?

Mr. ADAMS. Yes.

Mr. STUDDS. I will resist further observations.

Mr. ADAMS. We have seen rapid growth, in the past few years, in our marine program, in fiscal 1976, from a half million dollars to upwards of $2 million in 1979, and then to three and a half or so million in 1980.

The thrust in our program is primarily threefold. To identify plants and their cultivation potential; to identify techniques for the cultivation and conservation to fuels, and then to provide emphasis on systems that are using algae at the present time.

The macroalgae, consisting of giant kelp, for work in the oceans, and the microalgae are plants such as water hyacinths, or other immersed plants that use atmospheric carbon dioxide for nutrients onshore, or in the ocean.

Our focus is on algae at the present time because of such high yields, and the ease of conversion of these particular kinds of plants to liquids, and to gaseous fuels.

I have a number of major efforts in the biomass area, with work at Cal Tech, with Dr. North, and the giant kelp, an effort with GRI and GE on the use of engineering modules to direct nutrients to plants that are grown on a large scale, and a new effort in which we are trying to get hydrocarbon oils, such as glycerols, directly out of land-based systems.

We have efforts with Woods Hole Institute on ocean and fresh water algae, and their photosynthetic qualities, and we believe that this is extremely important, this and other related work that is being done on the basic research side of DOE, because one of the main factors in increasing the yield of biomass is the photosynthetic uptake, the conversion of the utilization of the sunshine to produce organic material.

We are doing extensive work on conversion of biomass, and our work on biomass conversion that is not directly tied into aquatic biomass would also be applicable.

I would just like to summarize my prepared remarks this morning by saying that we believe oceans, plus marginal lands, could

lend themselves to very large-scale biomass farming in the future. The potential is high. The potential for high yields and low costs is what drives us in this direction, coupled with the scarcity of land resources for growing, and competition for the fuel products.

Our key thrust at this time is to fill the needs for information, much more definitively than we have right now, about yields, about costs, and those factors that go into determining the economic viability of a project.

For instance, we know vastly more right now about growing corn than we do algae. There is a need for research and development in this area, to narrow the uncertainties, to identify new species, and to establish levels of performance.

Thank you.

Mr. STUDDS. Thank you very much. I tried to listen to you and follow your testimony at the same time, an exercise I did not do too successfully.

Your total fiscal funding is $58 million, is that correct?

Mr. ADAMS. That is correct.

Mr. STUDDS. What percentage goes to terrestrial and what percentage to aquatic biomass? You give us your little pie for 1979 here.

Dr. SAN MARTIN. The plans at this time are about approximately $6 million in 1980 will be devoted to aquatic biomass with $3.5 going to support marine biomass activities.

Mr. STUDDS. $3.5 million?

Dr. SAN MARTIN. Yes, sir.

Mr. STUDDS. All of that, if I understand your testimony, goes to GRI?

On page 6 of your testimony, you say, "We plan to spend an additional $3.5 million in fiscal year 1980 to obtain the information necessary to verify biomass yield."

Mr. ADAMS. Yes, sir, that is correct.

Mr. STUDDS. The entirety of your budget is going to one project?

Dr. SAN MARTIN. No, Mr. Chairman.

The entirety of the research budget and aquatic biomass will likely involve a dozen different major participants in the overall program. It will be $3.5 million as we are directed by Congress, in direct support of the GRI/GE marine work. Many of the other programs that are looking at establishing some of the technical facts concerning higher efficiency photosynthetic plant and conversion processes are also applicable to work in both land base aquatic systems and marine aquatic systems.

Mr. STUDDS. Let me see if I can understand in layman's language.

Looking at figure 1 in your testimony, which is the biomass breakdown for 1979, I want to see if I can put into English some of the phrases that describe the various portions of the pie here; 17 percent goes to assessment and support. I assume that is administrative overhead?

Mr. ADAMS. No, sir, those are marketing analyses, more on the software side.

Mr. STUDDS. What are the administrative costs in the biomass budget for fiscal year 1979?

Mr. ADAMS. $687,000 was budgeted for professionals in fiscal year 1979. Those figures are not shown in the 1979 budget. By administrative costs, do you mean payroll, sir?

Mr. STUDDS. Well, it is not volunteer work down there, is it?

Mr. ADAMS. No, sir; it is not. But those figures are not indicated here. I could provide those for you.

Mr. STUDDS. So when you say the biomass budget for 1979, you mean only those funds going to research grants of one kind or another?

Mr. ADAMS. Yes, sir; to contracts or direct support of those contracts.

Mr. STUDDS. It does not say that the program which you are responsible for does not spend more of the taxpayers' dollars, they just do not show up here, correct?

Mr. ADAMS. Our payroll, sir, does not show in this pie.

Mr. STUDDS. How many folks do you have working in this field?

Dr. SAN MARTIN. In Washington we currently have six professionals on the payroll, working in the biomass branch.

Mr. STUDDS. Six?

Dr. SAN MARTIN. Yes, sir. But in following the philosophy that the Department of Energy is currently utilizing in decentralizing the day-to-day technical management, we work with other organizations that supply additional technical experts to support these activities.

For instance, the portions of the biomass program are managed for us on a day-to-day basis by the National Solar Institute, and they have greater resources available to do this than we have at headquarters.

Mr. STUDDS. I understand that, but how many people work for the Department of Energy?

Mr. ADAMS. The figure that I hear is 20,000 people.

Mr. STUDDS. Of whom six are working in biomass?

Mr. ADAMS. Yes, sir; that is correct.

Mr. STUDDS. How many——

Mr. ADAMS. Six professionals, sir.

Mr. STUDDS. As opposed to clerical personnel, you mean.

Mr. ADAMS. That is correct. We have additional clerical.

Mr. STUDDS. Perhaps I should ask how many professional people work for the Department of Energy in the broader sense of the word.

Mr. ADAMS. I do not have that figure, sir.

Mr. STUDDS. I am just trying to get some relative figures obviously. How many professionals work in ocean thermal energy?

Mr. ADAMS. I do not have that precise figure for you, sir, but I believe the figure is eight.

Mr. STUDDS. Eight?

Mr. ADAMS. Yes, sir.

Mr. STUDDS. I do not think I dare ask any more questions here.

Let me go back to your pie. Thirty-two percent goes to thermal chemical conversion. In layman's terms, that is what?

Mr. ADAMS. That would be the application of heat to a biomass form, perhaps involving catalysis and perhaps steam to convert that to either gases or liquid products.

Mr. STUDDS. For example, the distillation of alcohol or what?

Mr. ADAMS. Distillation of alcohol would be biochemical process.

Mr. STUDDS. Where does Mr. Emery's wood stove come in here?

Mr. ADAMS. A wood stove would be in the thermal chemical split.

Mr. EMERY. I thought we used a match, Mr. Chairman.

Mr. STUDDS. I do not know if you folks up there are aware of thermal chemical conversion.

Are we doing research into wood stoves down there?

Dr. SAN MARTIN. No, Mr. Chairman. The wood stove business is.

Mr. STUDDS. Highly developed technology.

Dr. SAN MARTIN. Highly developed technology.

Mr. STUDDS. OK. Thermal chemical conversion includes things like the distillation of alcohol?

Dr. SAN MARTIN. Right.

Mr. STUDDS. Terrestrial biomass production, 9 percent; integrated production and conversion systems, 13 percent.

What is that?

Mr. ADAMS. That is a combination of captive farms of one sort or another.

Mr. STUDDS. Captive farms?

Mr. ADAMS. Captive farms in which the harvest would be cut and produced and then converted into thermal chemically or by some other means.

Mr. STUDDS. What is a captive farm?

Mr. ADAMS. It is an integrated facility where trees or some other form of biomass would be grown specifically for energy conversion as opposed to residues from the forest.

Mr. STUDDS. Do you really have, in a captive farm, which you perceive to be an entity, such as a tree, for lack of another word for it——

Mr. ADAMS. This would be a facility in which you could envision a conversion plant of one type or another with its own dedicated feedstock supply.

Mr. STUDDS. I apologize. We are dealing with a language barrier, as you know.

I did not realize it was an integrated facility. Do you, by any chance, have any research going on on the possibility of utilizing sewage sludge for conversion into methane or is there such a possibility?

Mr. ADAMS. No, sir; not under my direction. That could well be in another part of DOE and, in other words, the municipal solid waste program in DOE is under the direction of the Assistant Secretary for Conversion and Solar.

Mr. STUDDS. Do you ever talk with him or her?

Mr. ADAMS. Yes, sir; I certainly do.

Mr. STUDDS. But we have a lot of that stuff which——

Mr. ADAMS. We do not——

Mr. STUDDS [continuing]. We are putting into the oceans, so that is your department.

Mr. ADAMS. We do not ourselves conduct research into that area.

Mr. STUDDS. One final question and then I will turn it over to the other folks here.

I assume that a good deal of this research, or am I incorrect in so assuming, is going on in other parts of this country, and in other countries?

Mr. ADAMS. Yes, sir; similar research is going on in biomass.

Mr. STUDDS. I refer specifically to ocean biomass now.

Mr. ADAMS. I am not familiar with what other countries are doing. However, we understand that Israel does have efforts, and South Africa does have efforts in biomass, and China and Japan have efforts in biomass, and we have looked at those.

Mr. STUDDS. Is it just you that is not familiar because of your administrative responsibilities, or are your people familiar with the state of the art?

Mr. ADAMS. Our people are familiar with the state of the art. I personally am not.

Mr. STUDDS. How do we stand vis-a-vis other countries on this?

Dr. SAN MARTIN. I am advised, Mr. Chairman, that the total acreage in particular of ocean biomass that is farmed in some other countries exceeds what the United States is doing. I am also advised that the majority of that has typically gone for human food consumption.

My knowledge of the size of research efforts going on in other countries to support these activities are on the order of what we are doing in the United States or less.

Mr. STUDDS. I did not mean so much magnitude of acreage as sophistication of technology and whether they have answered some of the questions that we seem to be in the very early stages of trying to answer.

Dr. SAN MARTIN. Mr. Chairman, I do not believe on the technical side that we have at hand all of the detailed information to support that. I am finding through new investigations more and more data to support work that has gone on internationally in the entire biological field to support its use for food and energy, that has not been totally factored into the programs that we have developed.

Mr. STUDDS. Is similar aquatic biomass research being conducted by other countries? Are they ahead of us?

Dr. SAN MARTIN. There is aquatic biomass research going on in India, South Africa, Canada, Israel, France, Czechoslovakia, China, Japan, and Germany. The Chinese and Japanese have been farming the sea for food and medicine through mariculture of algae for several hundred years. They are unquestionably ahead of us in this work, but its objectives are almost totally devoted to surface cultivation for food and therefore the cost elements are not as important as they are for energy uses. Israel has done progressive work on both land-based aquatic plants as well as some ocean work. We consider their work to be of a very high quality and directed along lines that we have not yet begun to investigate. We have a cooperative agreement with them for information exchange and research cooperation. There have been reports that very high production rates have been achieved in South Africa. We expect to have some more detailed information about their program soon.

Czechoslovakia and Germany have advanced systems using algae as pollution control agents. Similar work has also been done in this country, partially by private initiative and partially under Government assistance through the Environmental Protection Agency. U.S. technology in the pollution control field is probably equal to any.

In certain areas, undoubtedly, there are advances beyond ours. We understand that the U.S.S.R. is conducting work in the field, but we have very little knowledge of their activities to date.

Mr. STUDDS. That sounds hauntingly familiar.

I assume that we are making an active effort to recover what we knew 30 years ago?

Mr. ADAMS. Yes, sir; we are.

Mr. STUDDS. We are not inventing the ocean biomass wheel, or are we?

Mr. ADAMS. I hope not.

Mr. STUDDS. I hope not, too, but you are in charge of it.

Mr. ADAMS. I can assure you that we are not, particularly when I see such wide degrees of uncertainty in growth leagues and cost and other factors like this. We believe that we are into a very fruitful area for research.

Mr. STUDDS. Very good.

The committee's expert on the California giant kelp, Mr. Pritchard.

Mr. PRITCHARD. Thank you, Mr. Chairman, for that dubious distinction.

Just a question here concerning the timeframe.

Unfortunately, I was tied up with another subject, and maybe you discussed this. But can you tell a layman, if I have to explain when I go home next week and I am talking about this, and somebody says, well, what does this mean and when will biomass conversion become a viable energy source? Is this something that I am going to be able to utilize or are we talking about something for our grandchildren? Where are we? Can you give me some timeframes for development in here?

I realize this is very vague and it has to be, but so that I can have a better appreciation for the time necessary to bring this technology along?

Mr. ADAMS. Yes, sir; unless we see breakthroughs, and after all, it is one of the purposes of research, unless we see breakthroughs that we can get our hands around reasonably soon, I personally do not see major contributions from aquatic biomass in this century.

In my prepared testimony, I indicated perhaps up to one quad, and I believe that that is an outside kind of number. Significant progress is going to be needed to be made in terms of yields and costs, both on land and in the ocean in order for this to come about sooner.

Now, by the same token, we are conducting a program in a manner that would not preclude those breakthroughs if they come. In other words, we would be able to capitalize on it and move it ahead quicker.

Mr. PRITCHARD. Well, it is endless, the area of research in a field like this because of the number of possibilities. It is almost endless where you could apply this technology and what it could do.

When we start talking about producing on land, of course, you are talking about land that is not being used for something else or this would have a higher calling.

Now, I would think that if you are talking about land that will produce the best, this is also the same land that is currently

productive farmland, is it not? You cannot do much out there around Nevada?

Mr. ADAMS. Yes, sir; we would see the terrestrial production of biomass as being done on marginal land. That would be land whose highest and best use might be for this purpose. That is certainly not without its problems. Water, fresh water availability is certainly a big factor in those areas with all the competition from water, for fresh water, for processes and agricultural purposes, particularly in the area out west. That certainly is a big factor just as there are technical factors in the ocean, and this is why it is my belief that at this early date, it is still too early for us to take a call as to which way the thing could go.

Mr. PRITCHARD. So if you get into growth of saltwater production, the possibilities are unlimited there—saltwater and sunshine and some nutrients, and you are in business?

Mr. ADAMS. Yes, sir; that is right.

The question of yield is certainly not the only question. Harvesting and the ability to harvest the material at an economic cost is certainly a big question there. These offset each other to some extent.

If we had extremely high yield, if we could achieve extremely high yield in the open ocean, then that would relieve some of the press on harvesting.

Mr. PRITCHARD. I would think also that if you are talking about saltwater, you could do it in areas where labor is in great surplus or extremely cheap. If it is something that could be portable, this would also help its feasibility. Not all energy sources can be moved reasonably, so this is almost a never, never land, at least for people like myself. It just seems like it is out there so far it is hard to grasp, and yet solutions like this are closely related to today's problems.

Mr. ADAMS. No, sir; I do not really believe it is a never, never land.

Mr. PRITCHARD. I should say it almost seems to people like us that it is out there and yet you are dealing in factors that are something that is 75 years away.

Mr. ADAMS. We believe that before the mideighties, with the sustained healthy research and development program, both on land and in the open ocean, a balanced program that we will be able to have answers that are clear enough to permit one to set priorities in a much better way than we can right now. Even to try to understand right now with any degree of certainty those factors that inhibit yield and growth rates and what can be done about them and new strains that can be utilized and how they can be cultivated, we just do not have the information to do it, and I do not believe that—I really do not believe that that sort of information exists elsewhere in the world; that we could readily tap and greatly accelerate what we know right now.

Mr. PRITCHARD. If you had to pick one thing among all the activities that you are involved with, that would, at this point have the best chance of coming to fruition, what would that be?

Mr. ADAMS. Sir, could you qualify that for me? Do you mean with respect to aquatic biomass?

Mr. PRITCHARD. Yes.

Mr. ADAMS. I believe from where I sit right now that the problems of cost and yield may be simpler to work on the land than in the ocean, and this is because I am looking at cost numbers in terms of dollars per ton in freshwater, based on various studies that in all these studies purport to be authoritative and we can get 100 different studies.

Mr. PRITCHARD. We get a lot of those.

Mr. ADAMS. Yes, sir; you can get numbers that look like $60 a ton, $140 a ton, kinds of numbers in freshwater, and in the open ocean I am seeing numbers that look like $170, $300, $500, $700 a ton and I would have to say that——

Mr. PRITCHARD. If that is the case, land sources provide more hope then, do they not?

Mr. ADAMS. I have to say this, sir, with great qualifications, because it is simply too early for me to make a forced choice like that.

If I made a choice like that, it would be—if I had to make a choice like that, it would be under the direst of conditions right now because I simply do not have the information to base a choice on. This is simply the data that are before me. If I have to go and had no way out of it in one direction or another right now, I think I would probably try to go in the land direction. But I hope we do not have to make that choice.

I think what I would say is that our effort so far has been heavier on the ocean side than it has been on the land side in aquatic biomass in that we are examining, we are trying to get the best handle we can on information to maybe conduct a more balanced effort. That is not to say that we are overspending in the ocean. Perhaps even the contrary.

But what we do need to prosecute is a healthier based program in order to achieve the balance.

Mr. PRITCHARD. I think the gentleman from Maine would probably agree with you.

Mr. STUDDS. Thank you, Mr. Pritchard.

I am sure Mr. Emery will offer to deliver to you any kind of seaweed for less than $700 a ton, if you would like.

Mr. Forsythe?

Mr. FORSYTHE. Thank you, Mr. Chairman. I am as bewildered as both my colleagues. It just seems to me that when we have been going through a period of energy source deficiency in this Nation it is critical that we continue research designed to develop domestic energy resources.

Mr. STUDDS. Mr. Emery, I suspect, will have questions regarding rockweed and Irish moss. Are you finished?

Mr. FORSYTHE. No.

Let me go to a question that is not directly in line with aquatic biomass or ocean biomass conversion. You have referred to land-based biomass conversion in many different ways this morning. I cannot avoid trying to satisfy myself on an issue that Forbes magazine pointed to grain alcohol as a negative biomass conversion since the input in grain alcohol would actually be in excess of the Btu available, principally because it is high level grain that is needed as the stock to produce this alcohol. It seems to me that

there is some logic to that when you are only using the grain out of the biomass in the whole stock.

Are you familiar with that report?

Mr. ADAMS. Yes, sir, I am.

Mr. FORSYTHE. I would appreciate your comments.

Mr. ADAMS. In the interest of time, sir, I will try to be very brief. This is a subject area that you opened up is one that——

Mr. FORSYTHE. It goes to the whole problem that we have got to look at or we will be trapped in finding ourselves needing more oil to produce the biomass product.

Mr. ADAMS. Yes, sir. We have wrestled with that problem in DOE a great deal. A lot of the dilemma on the net energy accounting which you referred to on production of alcohol, really depends on how one accounts for it. How the accounting is done, where the circle is drawn around the total system, and even if one takes a very conservative accounting, and counts every iota of energy that goes into produce alcohol, it need not be a negative producer.

One of the main reasons why alcohol——

Mr. FORSYTHE. We are limiting ourselves to grain alcohol or ethyl alcohol?

Mr. ADAMS. Yes, sir. Even with grain alcohol, it does not have to be a negative producer, and one of the fundamental reasons why so many studies show that it is is because the way conventional distillation is done to purify and get to an anhydrous state of alcohol, that is essentially dry alcohol, which indeed it has to be for—or it should be, it is desirable for it to be with use of motor gasoline because otherwise one would get separation with the water. So it needs to be essentially anhydrous and that distillation step is extremely energy intensive. It is the nature of alcohol and water to boil at a constant temperature, they form a constant boiling mixture. There are ways to get beyond that constant boiling point that have been known for years in the petrochemical industry, chemical processing industry that do not involve such an energy intensive step.

We are working on those.

Mr. FORSYTHE. Well, let us try to simplify this. Is the technology available today in use.

Mr. ADAMS. Yes, sir.

[The following was received:]

PRODUCTION OF GRAIN ALCOHOL

The total output of energy in the production of grain alcohol is about equal to the input of energy. This information is based on the use of corn as a raw material and includes energies expended for plowing, seeding, fertilizing, tilling, harvesting, and processing. Credit is taken for useful by-products such as Distiller's Dried Grains and fractions of other chemicals derived from the fermentation and distillation process. This credit can be offset if biomass issued for process heat instead of oil or natural gas.

The use of ethanol in gasoline as an octane enhancer removes the need for the additional octane additives in unleaded gasoline. As a consequence, more gallons of gasoline may be refined from a barrel or crude oil.

The Btu input for the production of alcohol equivalent to 1 million Btu are as follows: corn cultivation and harvesting—436,000 Btu; processing into alcohol—647,000 Btu. The Distiller's Dried Grains yield 139,000 Btu and, if included in the energy output from the process, result in a slight positive net energy balance. In comparison, the energy content of the unprocessed corn is 1,770,000 Btu.

Mr. ADAMS. If one takes that alcohol all the way to essentially an anhydrous state——

Mr. FORSYTHE. You have got to if you are going to burn it in an automobile.

Mr. ADAMS. No, you do not.

Mr. FORSYTHE. No?

Mr. ADAMS. No, sir; you do not. You can run it without fixing it with gasoline and run it as 180-proof alcohol.

Mr. FORSYTHE. 180 proof, all right.

Mr. ADAMS. And stay completely away from the so-called acetophric distillation. Stay completely away from that and just burn it as alcohol without mixing it with gasoline.

Mr. STUDDS. I am going to have to interrupt for a minute.

Mr. Adams, at the risk of delaying the entire national research program, which we are interested in accelerating, we are going to have to ask you if you possibly can return at 1 o'clock. What we face now is a series of votes so there will be little point in running back and forth every 10 minutes.

So we are going to recess the subcommittee until 1 o'clock. Would it be possible for you to return? I am told that both Mr. Forsythe and Mr. Emery have a number of questions, and I would urge you in the interim to do much research on the northeastern rockweed and Irish moss.

Thank you very much. The committee is adjourned.

[Whereupon, at 11:43 a.m., the subcommittee recessed, to reconvene at 1 p.m., the same day.]

AFTERNOON SESSION

Mr. STUDDS. The subcommittee will resume.

Thank you very much, Mr. Adams, for returning.

Mr. Forsythe will now ask his questions and then do his best possible imitations of Mr. Emery.

Mr. FORSYTHE. That is a challenge that I would not even touch, Mr. Chairman.

I think we were in the middle of this problem of Btu's and alcohol primarily. I think it is of great concern that we try and be very sure that we keep this record clear, and I am not talking about your testimony specifically. I am talking in the broad sense.

I think it is very easy for members, most particularly those perhaps who do not have a scientific background to get out in left field with energy inputs that are just unreal. I am not actually positive, before we departed for lunch, where we left you, Mr. Adams. Did you have further comments to make? If not, I would like to talk about methyl alcohol and methane, as opposed to the grain alcohol. Is there not a basic net plus in the fact that we are utilizing the total net base rather than just the general seaweed?

Mr. ADAMS. I have not personally, although people who work for me in the organization may well have looked at the net energy on the methyl energy question as opposed to the fermentation processes.

I would say this much about it, though. The processes involved are very different from an engineering standpoint, very, very different kind of processes, to produce methyl alcohol. The most straightforward way would be to gasify the biomass and produce a

mixture of a reactive gas called synthesis gas, which could then be taken to the next step to produce the methyl alcohol, so it is essentially a thermal chemical, to use that earlier term, as opposed to a biochemical process common to the production of ethyl alcohol, which involves fermentation.

Now, doing this avoids the costly kind of distillation that you end up with if you ferment a mixture, and end up with 12 or 14 percent ethyl alcohol in a mixture of water, which then must be distilled, because in other words you are selectively manufacturing methyl alcohol. The method of reaction is known as indirect, it is an indirect conversion process, and can always utilize coal as the feedstock.

Mr. FORSYTHE. Of course, the technology is here. Is there anything new about methyl alcohol or ethyl alcohol? It gets down to the feedstock involved, does it not?

Mr. ADAMS. Yes, sir.

Mr. FORSYTHE. And these economies of scale in that regard, as to what we can really get as the input. Whether we are going to kelp so far as ocean mass, biomass input, or whether it is going to be vegetation, nobody seems to have mentioned Brazil, for instance, but they are talking about—yes, going the ethyl route, in using sugarcane, where they have got a climate that is almost ideal—a climate that we could not duplicate in the continental United States.

I hope, Mr. Chairman, Mr. Emery does get here, because I know he has an interest in this very area. He has been a promoter, for instance, of conversion of wood products, particularly in Maine, into methyl alcohol for automotive use specifically.

What are the cost factors for the conversion of biomass produced on land versus ocean?

Mr. ADAMS. The actual conversion costs for terrestrial and aquatic biomass are probably on the same order of magnitude. The raw material costs on a dry weight basis are likely to be lower for land-based biomass than for fresh water/sea water derived biomass. The reason is the cost involved in harvesting and concentrating the aquatic biomass. The potential of aquatic biomass for very high production rates is well documented and, if realized on a large scale, could reduce raw material costs dramatically. However, technically and economically viable systems have yet to be demonstrated.

Mr. Forsythe, if we know a better source of information, I am not aware of it right now. We would be happy to put together a compendium of information for you, which summarizes what we do think we know.

Mr. FORSYTHE. I think that would be important.

Mr. ADAMS. And submit it for the record as a compendium of material, but as far as levels of confidence that one would place in the information right now, I cannot stress enough the still early nature of it.

Mr. FORSYTHE. This is somewhat mystifying, because we are really talking about technology of products that are certainly time honored, in both ethyl alcohol, maybe a little more time honored in methyl, but that is nothing new basically here in what you do in the way of feedstocks, and where it comes in, in the cost range, and

the cost of growth, and considering a part of that cost that has to be tied to that formula, is the energy cost of Btu input.

Mr. ADAMS. Yes, sir.

Mr. FORSYTHE. Because my suspicion is, you get into high dollar cost without even looking at the energy formula. The high dollars are going to represent Btu's in many, many ways.

Mr. ADAMS. Yes, sir.

Mr. FORSYTHE. So if you can help us in that regard, I would appreciate it.

Thank you for your testimony.

You have intrigued me greatly.

Mr. ADAMS. Could I have one more moment, sir, to respond to a couple of points that you raised earlier, that I wanted to address?

One was the list of activities, and why, after this whole series of work, since 1972, we do not have that tied down better than we do right now. Why we do not have a better handle on the economics.

Well, up until just 1978, most of that work has been what you might call breadboard work, very small scale work, or work of a steady nature. Only recently have we begun to undertake the large scale work that would let us begin to understand what the cost and economics would be. That is the first point that I wanted to indicate.

The second point that you made this morning, about if we made a lot of alcohol from grain, would we not end up importing more oil?

Just one more point, because I did take us into kind of a technical discussion, to indicate where the energy intensity is, as it pertains to the distillation process. As a practical matter, the ethyl alcohol used, according to the recently completed DOE policy study on alcohol, will not be so large that it would cause such perceptible changes, and indeed, we believe that grain alcohol can make important local and community level, or regional even, contributions in the near term. It is a near-term liquid hydrocarbon option, which as you indicate we do know how to do.

By the mideighties we think we are going to be in a position to make ethyl alcohol in a straightforward manner, much more straightforward manner, from products which are not edible raw materials that are so competitive, things like cellulose, cellulose material. We think that we will have the technical knowledge together to do that, and understand what the costs are.

Mr. FORSYTHE. Well, thank you very much, Mr. Chairman.

Mr. Emery has arrived.

Mr. STUDDS. Mr. Emery, your turn.

Mr. EMERY. Thank you very much.

I wonder if you could tell us what you have done in the arena of harvesting various kinds of seaweeds, especially rockweed, or kelp, Irish moss, or any of these common indigenous algaes? Have you done any specific work with the technique of harvesting them by machine as opposed to harvesting them by hand?

Mr. ADAMS. I cannot answer that.

Bob, do you have an answer to that?

Dr. SAN MARTIN. Mr. Emery, our work in that area has been relatively limited. Even though we have been working since 1976 with individuals at Columbia University, looking at harvesting and

collection mechanisms for different types of biomass materials, the direct harvesting mechanical work, some of that today is also being supported by the GRI effort, where they are looking at techniques that can be applied to that concept.

Mr. EMERY. The reason I asked is because in my hometown, which is Rockland, Maine, there is a company which produces a very significant portion of this Nation's output of seaweed products, carrageen and other materials. They are in the position of buying a certain percentage of their seaweed, their raw material, from halfway around the world. In the other areas of the world the terrain allows the harvesting of this material by machine. The New England coast is anything but smooth, which makes harvest difficult to do any other way than by hand.

You ought to look at existing pieces of equipment around the world that are used for harvesting various kinds of seaweed. You should also do some work relative to the energy content, or the feasibility of converting various types of material, different kinds of seaweed into usable energy supplies in various ways. Do you have any background on the feasibility of using one kind of seaweed versus another kind of seaweed?

Have you ever done any kind of work on different species, or do you consider it all as one mass, treated the same way?

Dr. SAN MARTIN. Our program to date, Mr. Emery, has focused on just a few particular species. We are looking to expand that, because there are so many available that can be used, and look at those, so that we can, from a stronger knowledge base, be able to priority, range which are the most promising ones, as versus attempting to utilize those species that are indigenous to a particular area.

Mr. ADAMS. Our work at Woods Hole is targeted, you know, in that area, and is looking for different species. I only know enough about the species question to be dangerous with it, but it certainly indicates, from the reading I have done, and the information that I have been given, that certain kinds of seaweed appear to be promising.

Mr. EMERY. That is what we are talking about.

Mr. ADAMS. Seaweeds, as opposed to other particular strains of biomass material.

Mr. EMERY. That is what we are talking about, Irish moss, rockweed, kelp. All pretty much characterized as a seaweed. They are all algaes.

One interest that I have is the possibility of using rockweed. It is in great proliferation, tremendous proliferation, all up and down the coast of New England. It also exists in the tidal zone, which means it can be harvested by people at low tide. It would almost certainly have to be harvested by hand, rather than machinery of any large scale, because of the nature of its growth.

With this tremendous abundance, on just about every rock in North America, on the ocean, there ought to be some way to harvest this at a much lower price than that which was mentioned earlier. Then the question remains of the most efficient way to use the biomass for energy.

Have you had a chance to do any studies to determine the most effective way to extract some kinds of energy? I suppose it could be

used in an anaerobic process, to produce methane, or it could be possibly fermented in some fashion, but I do not know the characteristics of those algaes, to determine whether or not that is feasible, and I suppose actually you could even use the material if it were dried in the pyrolysis process to produce methanol.

Can you give us a comparison of the relative energy advantages to those three different steps?

Mr. ADAMS. I cannot provide that for you today, but I would be happy again to submit that for the record.

[The following was received for the record:]

HOW ANAEROBIC DIGESTION, FERMENTATION, AND PYROLYSIS COMPARE IN EXTRACTING ENERGY FROM OCEAN BIOMASS

Pyrolysis cannot now be justified because of the high cost of drying the feedstock to a moisture content of 10 to 20 percent by weight. For anaerobic digestion and fermentation, equivalent amounts of energy could be produced: methane from anaerobic digestion and alcohol from fermentation. However, the alcohol has a higher market value per Btu than the methane gas. On the other hand, the processing costs for methane gas are lower than those of alcohol. Market needs and prices would therefore determine which conversion technology to use.

From an economic point of view, it would make better sense first to extract higher valued components from the ocean biomass, such as algin and mannitol, before digesting or fermenting.

Mr. EMERY. I guess what I am struck by is the fact that we have been spending a lot of money. I do not know how much it adds up to, but it is more money than I have ever seen before, and these are basic questions that I have asked, that you do not seem to have the answers to. Nor do you seem to have done the necessary research to determine the harvesting feasibility, the energy contents, or various kinds of energy materials that might be manufactured. I am a little surprised at that.

Mr. ADAMS. I personally have not reviewed all those reports, Mr. Emery. I am quite certain that people in my organization have. But I personally have not, and this is why I simply would like to get back to you with a more concrete answer.

Mr. EMERY. I would appreciate that very much. It just strikes me that after the research that has been done, which I think we are all interested in, I am a little surprised that you could not determine whether or not some of these questions have been answered. You know the availability of the material, the energy resource that is manufactured, and the method of manufacturing. These are the most basic questions that anyone could ask.

It is apparent that we have to do more work in this area, or at least do a better job in researching the material that has already been assembled. We have a tremendous resource on the coast of the United States, if we could find a way to develop it in a feasible manner. I think it probably exists.

I have no further questions.

Mr. STUDDS. The gentleman serves on the Armed Services Committee. I assume he means he has never seen sums of money this small.

Mr. EMERY. Not having an immediate comeback, I will let that slide.

Mr. STUDDS. Mr. AuCoin, the distinguished ranking member of the subcommittee.

Mr. AUCOIN. Thank you, Mr. Chairman.

Mr. Adams, we have heard higher projections than yours, of ocean biomass potential, from private researchers, who have given information to the committee. You have stated that the ocean biomass could conceivably provide energy equivalent to the current energy needs of the United States, which is roughly 78 quads a year.

At your current rate of activity, do you believe that this is likely ever to develop?

Mr. ADAMS. I think the chances of that, sir, are pretty small, of achieving a level of 78 quads from aquatic biomass. Certainly, in my lifetime.

Mr. AUCOIN. And yet that is the potential you see? You have indicated that that is the potential you see, for potential source of energy, but at your current rate of activity, or level of activity, you doubt seriously that that goal or objective could ever be reached?

Mr. ADAMS. Yes, sir, I certainly do. In fact, I think in my testimony I indicate that a number up to one quad by the year 2000, from aquatic sources of biomass is about what we think the real listing potential to be.

Mr. AUCOIN. Potential to be at your—given the existing levels of commitment to this source of energy?

Mr. ADAMS. Assuming reasonable successes with an R. & D. program of the type that we are prosecuting, in trying to prosecute, that would be based between ocean and terrestrial systems.

Mr. AUCOIN. What do you mean by your statement that the long-range potential might be equivalent to the current energy needs of the United States?

Mr. ADAMS. Well, I think it would be entirely feasible over the long range to grow that much material in the ocean.

Mr. AUCOIN. But if we move forward on a policy basis at a snail's pace, obviously we are not going to get there.

Mr. ADAMS. Yes, sir, that is correct, or at a slower rate. The numbers are staggering in that.

Mr. AUCOIN. Is the rate that we are proceeding at right now, a weakenss then in our energy position, or policy, as you see it?

Mr. ADAMS. At the present time, I do not think so. I think that in a couple of years, by 1982, or by 1983, when we determine the results of the present efforts, that we are into on land and terrestrial systems, that we will be in a much better position to move forward with wisdom about it.

The numbers are staggering, indicating, you know, numbers in the range of all the way from 3,000 square miles per quad per year to 90,000 square miles per quad per year. One number is even as low as 900 square miles per quad per year.

So when we have such wide degrees of uncertainty in the yields, of the biomass, it is hardly practical to make an assessment, it seems to me, about how much contribution aquatic biomass can make to our energy future in this century.

Mr. AUCOIN. Of course, the way to overcome that uncertainty, and the way to make more informed decisions, is to accelerate our efforts to find those answers.

It would seem to me that what we have here is in pretty much of a go slow approach, and that would be a weakness that I would see in our energy posture at this point.

Mr. ADAMS. From the prospective of the program.

Mr. AUCOIN. The slower you go the longer it is going to be to get the answers that you just identified that we need to find.

Mr. ADAMS. Yes, sir, I agree with you. From the prospective I gave this morning, however, I would indicate to you again that it is my opinion that if we are going slow, in any of the areas, it is slow in the terrestrial base system, relative to the ocean system.

Mr. AUCOIN. Let me ask you this. In your judgment, would it be feasible on a technological basis, for individual households to operate bacterial digestors to produce methane for their own use in the United States?

Mr. ADAMS. I simply cannot see that on a wide basis in this country. But we have seen it in China.

Mr. AUCOIN. You have seen it in China?

Mr. ADAMS. Yes, sir.

Mr. AUCOIN. I have seen it in China. Why can we not do the same thing?

Mr. ADAMS. We have seen rather large programs of that nature in China, hundreds of thousands of homes or more, oriented in that direction.

Mr. AUCOIN. And China is one of the most primitive, backward countries in the world, but we cannot do it here?

Mr. ADAMS. Of course, the technology is relatively primitive and backward, and lends itself to more or less to communal types of living, and it is also carried out in China by——

Mr. AUCOIN. That is my definition of the suburbs.

Mr. ADAMS. But the work is also done in China by groups of people who live together and do that as voluntary work.

When you ask me about how practical, or how feasible, I think that would be for this country, I am simply reflecting more or less, on the type of lifestyles that we have become accustomed to.

Mr. AUCOIN. I do not think that this energy technology is a tool of the socialist state, is a requirement for membership of the Communist Party, or the Peoples' Republic of China, or that one has to be living in a Chinese-style commune, in order to develop the technology. The technology can be used there, it can be used here.

What are the cultural hangups that you see? I just do not understand that.

Mr. ADAMS. I do not mean to be flippant about this, but I live also in the suburbs, in northern Virginia.

Mr. AUCOIN. What is the name of the commune?

Mr. ADAMS. I am trying to envision how I would do that, organize my own townhouse community to do that. I simply do not have the answer to that question.

Mr. AUCOIN. Has DOE done any work on the whole question of small digestors of this kind? Is there any work done by DOE at all on this question?

Dr. SAN MARTIN. Our small digestor work has addressed problems that could be resolved for farm-type applications, more the rural-type applications.

Mr. AUCOIN. For what?

Dr. SAN MARTIN. Farm-type application, where instead of attempting to utilize the human waste or sewage, we would be utilizing animal residues in the digestive process, and low type cost of

systems so that the farmer or an individual in the rural community could generate a good deal of their own gas needs.

Mr. AuCoin. Would it be a good idea to expand that research, and see if you could have nonrural application, nonfarm applications?

Mr. Adams. I think that we will be able to have—I do not have the answer to that right now, but I think that——

[The following was received for the record:]

*Question.* How practical are small waste digestors for urban dwellers?

Answer. Single, urban families do not generate sufficient waste to make small digestors practical. Furthermore, small urban digestors are not practical for most areas in the United States because they require heating to 95° F. This heating capacity is provided by the mild climate in many of the so called Developing Countries where small digestors are used, for example, India, Southern China, Taiwan, and the Philippines.

*Question.* Would it be a good idea to expand research on small scale digestors for non-rural, non-farm applications?

Answer. The DOE has an extensive program in anaerobic digestion of animal and agricultural wastes. Both large scale and small scale digestors for farm application are being developed to advance the technology. Work is going on at Cornell University and other universities and agricultural stations. This work is in collaboration with the U.S. Department of Agriculture. In fiscal year 1980 intensified efforts are being directed to improve the designs for small scale use, in order to provide off the shelf equipment and simplified technology.

DOE efforts are also being expended on the potential of using agricultural wastes, for example straw, as gas producing commodities. While technical improvements have been made, costs will remain high for the value of gas produced.

Further work has been proposed by Cornell University on an innovative anaerobic digestion system developed by the Chinese. The Chinese effort is a national one, using ponds constructed in communes. It works and is effective in the Chinese culture, but is directed more toward pollution control of villages and communes. The program is to direct more efforts to producing systems that can be applied to smaller communities, up to ten thousand population for the purposes of both pollution control and for production of gas that can be used to substitute for fossil fuel.

Mr. AuCoin. You do not know if that would be a good idea?

Mr. Adams. I think that I would like to get back to an answer to you, after the public meetings, that we are having on October 28 and 29, looking specifically to answers about solar energy applications in the cities. That is specifically the focus of DOE public forum which we are having, and that is one of the panels that will be held, and I am extremely interested in the results of that panel work, because so many of the renewable technologies seem to work extremely well in the countryside, but we also have to do something about problems in the cities, where people live.

Mr. AuCoin. But you are unable to tell me whether it might be a good idea, until that meeting is held?

Mr. Adams. I would like to have the input from that

Mr. AuCoin. You mentioned in your statement that the bacterial digestion process produces both methane and carbon dioxide.

Has the Department determined how much impact this would have on carbon dioxide problems in the atmosphere, and does the amount of carbon dioxide released in the manufacturing and use of biomass methane compare with the amount of carbon dioxide released in the comparable amounts of coal? Have you made any comparable comparisons on that question?

Dr. San Martin. On the specific level that you are asking, I am not aware of any definitive studies that have been undertaken.

If I could have the liberty to answer a more general type of question.

Mr. AuCoin. This is more of a specific question that I posed, and I wonder if the Department has made comparisons of that kind. Do you have that information? Is that information at hand?

Mr. Adams. I am not aware of that data.

Mr. AuCoin. Would it be a good idea to have that kind of information?

Mr. Adams. Yes, I do think it would be.

Mr. AuCoin. Do you need to wait for that meeting that you mentioned before providing that information to the committee?

Mr. Adams. No, sir, we will certainly see what we can find.

Mr. AuCoin. Thank you very much.

I have no further questions.

[The following was received for the record:]

Carbon Dioxide Pollution

Carbon dioxide pollution is the subject of an extensive research effort on the part of DOE's Basic Energy Sciences Office in collaboration with the National Academy of Sciences. This study is treating all aspects of the problem, including biomass and coal. The data is extensive but not yet complete. The following is a simplified view of the $CO_2$ balance. $CO_2$ pollution is caused by burning substance which have not taken up $CO_2$ in the geologically recent past. If the United States consumes 10 quads of biomass each year for energy and is also growing biomass at that same annual rate, the net annual contribution of $CO_2$ is zero. On the other hand, if 10 quads of coal are consumed, almost every molecule of carbon in the coal is released as $CO_2$ without a corresponding mechanism to reabsorb the $CO_2$.

Mr. Studds. Thank you very much.

Mr. Adams, your testimony will not be discounted solely because you are a resident of northern Virginia.

I also want the record to reflect that I do not think Mr. Emery meant to indicate that the harvesting of Irish moss off the coast ought to be mechanized. It has traditionally been harvested by dory, and several people have met their just desserts in attempts to mechanize.

Mr. Emery. I agree with the gentleman. It has been harvested by dory and by hand.

Mr. Studds. A lot less than $750 a ton. When I was doing it, we got 2 cents a pound. I am interested to see who is getting $750 a ton for giant kelp.

Thank you.

Mr. Adams. Thank you.

Mr. Studds. Our next witness is Dr. Ab Flowers, director of the Gas Research Institute.

Mr. Flowers?

**STATEMENT OF DR. AB FLOWERS, DIRECTOR, GAS SUPPLY RESEARCH, GAS RESEARCH INSTITUTE, ACCOMPANIED BY ALAN TOMPKINS, BIOMASS PROGRAM MANAGER, GENERAL ELECTRIC CO.**

Dr. Flowers. Mr. Chairman and members of the subcommittee, I am Dr. Ab Flowers, director of gas supply research for the Gas Research Institute, a not-for-profit, scientific organization that plans, finances, and manages a gas-related research and development program. I am pleased to appear before you today to provide information on the marine biomass research program being conducted by the GRI, in conjunction with the Department of Energy and New York State ERDA.

Before proceeding to a brief discussion of GRI and its research efforts in marine biomass, I want to commend the subcommittee for holding a series of hearings calling attention to the potential that ocean energy resources have to contribute toward improving our domestic energy supplies. It is important in the push to develop synthetic fuels that all supply options be given consideration in determining the future U.S. energy product mix. Certainly, fuels from renewable biomass resources in general, and clean substitute natural gas from marine biomass feedstock in particular, can help to lessen U.S. dependence on foreign oil, as can the clean use of fossil fuels and conservation.

In the case of GRI, our R. & D. program aggressively seeks to develop both new gas supplies and more efficient gas using equipment. The GRI charter requires this balanced approach to serve both gas customers, who ultimately pay for the research and the gas transmission and distribution companies, who are our members. GRI is unique in that its R. & D. plan is formulated with the advice and consent of four advisory groups representing consumer, labor, environmental, engineering, scientific, and industry interests. Its activities are funded through a mechanism that subjects the annual R. & D. program to critical review and subsequent approval by the Federal Energy Regulatory Commission and State utility regulatory commissions. This mechanism provides for a uniform funding unit to be attached on a one-time basis to all volumes sold. The criteria established to judge the GRI program allows only R. & D. which will clearly benefit gas ratepayers. In 1979, this research effort was approved at a $40 million level.

I would like to now turn to a review of the marine biomass project. It has been my pleasure to manage this program since its inception in 1974. This program was started by the gas industry 5 years ago in recognition of the fact that a renewable source of methane was essential to the long-range future of adequate gas supplies from domestic resources.

Why biomass? Biomass, as a source of carbon for the production of fuels, and specifically substitute natural gas (SNG), has several attractive features. The primary energy source—the Sun—is inexhaustible and the source of carbon is, therefore, renewable since we are growing the fuel resource. The Gas Research Institute, as well as the DOE and other agencies, has studied alternate concepts for the production of biomass which could be suitable for conversion to substitute natural gas. These studies have all shown a practical upper limit of 7 to 11 quads per year of energy may be available by utilizing all of the potentially available land. Because land-based forms of biomass would be competing with food, feed, and fiber crops for valuable acreage and water supplies, an ocean source of feedstock was the preferable approach for long-term consideration.

It was from this perspective that the marine biomass project was initiated. The project has as its primary objective to determine the technical and economic feasibility of a system for the production of methane—or substitute natural gas—from giant California kelp, or *Macrocystis pyrifera,* grown on manmade structures in the open ocean. Giant California kelp was selected as the marine biomass to be used as the result of a study conducted by the California Institute of Technology in 1974. The characteristics which led to its

selection were its high growth rate; its size, structure, and growth patterns which allow it to be mechanically harvested; its long life and continuous or year-round growth cycle; photosynthate translocation within the plant tissues that counters problems of self-shading; and very high nutrient absorption capabilities resulting from the extensive exposed blade surfaces.

Giant kelp is, and has been since the 1930's, commercially harvested off the coast of California for use as a food additive and animal feed supplement. Recent harvests have been running between 100,000 and 160,000 tons a year. Institutionally speaking, this existing practice is a plus. Moreover, kelp's widespread natural occurrence and the success of laboratory growth experiments plus the natural growth of other algae in waters of the three major coastal zones of the continental United States indicate that many of our waters may be utilized as site locations for commercial kelp farms.

Studies and economic analyses of potential commercial systems performed to date have shown that kelp yield per acre of ocean farm area, using deep water as the source of fertilizer, is one of the key parameters affecting both initial capital requirements and unit gas costs. Projections of kelp yield potential were made based on the range of *Macrocystis* crop densities observed in natural beds coupled with observations of several investigations of the range of growth rates in adult plants. This study suggested the range of yields that are potentially achievable. The study predicts yields ranging from 25 dry, ash-free tons per acre per year, up to 105 dry, ash-free tons per acre per year, assuming continuous fertilization. in order to provide a data base on yield of a large number of adult plants, under controlled conditions, we have, in cooperation with the Department of Energy, designed, constructed, and installed a test farm in the open ocean approximately 5 miles off the coast of southern California to be used as an experimental station to conduct kelp yield experiments on 100 adult kelp plants in a controlled fertilization environment.

Yield experiments will be conducted by the California Institute of Technology through funding provided by the Department of Energy under a separate contract.

To date, the gas industry has provided $3.4 million and the DOE has provided $3.6 million to this program. The DOE programed $1.2 million in fiscal year 1978 funds to maintain the schedule of deploying the test farm. In fiscal year 1980, the program is budgeted for a total of $6.2 million, with DOE contributing $3.5 million, GRI $2.4 million, and New York State ERDA $355,000.

Since the farm was deployed approximately 1 year ago, much has been learned. Last December, 100 adult plants were transferred from shallow waters near shore, where they had been stored, to the test farm. A curtain, designed to retain upwelled nutrients and protect the plants from abrasion on the structure, was then installed around the farm and a period of observation and data collection was begun, including weekly measurements of growth of juvenile fronds, analysis of dissolved nutrients in water samples, and blade tissue analysis.

Initial observations of curtain performance based on underwater photography and plant tissue analysis provided clear evidence of

the effectiveness of the curtain in reducing currents. Storms during the month, however, began tearing the curtain at its points of support and, by the end of the month, most of the curtain was lost. The effect of the loss of the curtain combined with intense storm induced currents and waves as well as resulting motions of the farm, was the abrasion of many of the plants against the test farm structure. The intensity of the storms began increasing during January, causing further attrition such that by month's end, the useful population was reduced to 18 plants. By the first week of February, there were no viable transplants left on the farm.

During May of this year, extensive occurrence of new plants was observed on the farm. The new plants resulted from spores released by the adult transplants. Measurements of growth and nutrient uptake by those plants which are being supplied with artificially upwelled water, indicate that they are thriving in the test farm environment. This occurrence is a major milestone in demonstrating reproduction and development of juvenile plants on an open ocean structure. The study of these plants has been incorporated into the test program.

Action will soon be underway to select a stronger curtain material and to change the curtain assembly design to provide additional protection for the plants. It is planned that after the redesigned curtain has been installed, the farm will be replanted with as healthy plants as can be obtained. These will be taken directly from natural beds to the test farm.

Thus, in sum, first year deployment of the test farm has revealed:

One, the test farm upwelling system has performed as designed; providing 9,000 gallons per minute of water containing from 25 to 32 microgram-atoms per liter of nitrogen in the form of nitrates and nitrites.

Two, the test farm's mechanical structure has performed as designed, and the integrity of the test farm's mechanical structure continues to be sound.

Three, the curtain device used to reduce or deflect currents in the immediate vicinity of the plants and thereby retain nutrients around them, works, but the curtain design must be modified to increase its survivability and to protect the plants from abrasion on the structure during periods of high currents.

In order to determine overall system economics, integration of kelp production research with development of biomass conversion technology has continued. In the past year, work in the gas generation area has brought about the following achievements:

One, digestion of kelp is providing gas yields equal to or greater than the other types of biomass.

Two, digestion has been conducted at ambient temperature with marine derived inocula, at a liter scale, with no loss in gas production.

Third, digestion has been conducted at salt concentrations of up to 4 percent—seawater is 3 percent—at a 10-liter scale using sewage derived inocula by feeding undiluted kelp directly to digestors.

These findings have significant implications for the system economics. The higher gas yields and lower digestor temperatures

indicate kelp can be processed in digestors that are smaller and less complex than conventional digestors considered for biomass conversion. In addition, the fact that fresh water is not required for processing reduces the potential environmental impacts of the processing facility, as well as allowing for simpler and lower cost operations.

With these accomplishments, problems and objectives in mind, the proposed fiscal year 1980 joint DOE/GRI/New York State ERDA program will focus on the following areas:

One, continued operation of the existing biological test farm for kelp growth and yield experiments.

Two, initiation of characterization and site studies of New York State and other Atlantic waters and laboratory growth and conversation studies involving kelp and native species grown in Atlantic waters.

Third, initiation of alternative site studies in other U.S. coastal waters including the gulf coast, Hawaii, and Alaska.

Fourth, performance of kelp planting experiments and design studies leading to construction of an engineering size digestor in fiscal year 1981.

Fifth, initiation of studies to examine institutional and environmental issues. Large scale ocean farming may pose questions regarding the multiple use of ocean waters, the adequacy of existing permit processes for commercial ocean activities, and the potential impact of kelp farming on the surrounding aquaculture.

Technical barriers facing us over the next few years involve the design of cost-effective and reliable farm structures and the demonstration of continuous commercially feasible yields from controlled cultivation of the kelp. These challenges include developing a farm structure that can withstand ocean storms, assure maximum plant growth year-round, and minimize energy requirements in growing and harvesting.

Other areas of work requiring added research in the future include alternative site experiments, the development of a wave powered pumping system, the development of various genetic strains of *macrocystis pyrifera* to maximize the methane yield and to allow cultivation in other U. S. waters, the investigation of other plant species for open ocean farming, and the study of mariculture production and byproduct recovery for utilization as a feed or fertilizer or nutrient recycle to the farm.

In summary, the Gas Research Institute is aggressively supporting, in cooperation with the Department of Energy and New York State ERDA, a research program to determine the feasibility of farming the ocean for biomass to be used for the production of substitute natural gas. In recognition of the importance of this program, the Gas Research Institute has budgeted approximately $26 million for research in this area over the next 5 years with a fiscal year 1980 commitment of $2,375,000. New York State ERDA has budgeted $335,000 for fiscal year 1980. To keep the program on schedule, Congress has recently appropriated $3,500,000 of DOE funds in fiscal year 1980. Our enthusiasm for the program is based on the following assessments:

One, a virtually unlimited potential exists for growing a huge biomass resource in the ocean.

Two, preliminary studies indicate gas costs would be competitive with other SNG sources.

Third, the biomass is a renewable resource with no apparent negative environment impacts.

If the technical challenges we face can be overcome, we believe an ocean system of this type can provide substantial amounts of renewable energy.

I am pleased to answer any of your questions. With me today to assist in this regard is Mr. Alan Tompkins, biomass program manager for the General Electric Co., who manages the project for DOE and GRI.

Mr. STUDDS. On page 6 of your testimony you say "Digestion of kelp is providing gas yields equal to or greater than the other types of biomass."

On page 9, you say, "Preliminary studies indicate gas costs would be competitive with other synthetic natural gas sources."

Can you give us some actual figures with respect to relative yield between this and other sources of types of biomass and with respect to relative cost projections?

Mr. TOMPKINS. In terms of the gas yields, we have gone to the literature and have looked at yields in cubic feet per pound of volatile solids added to the digestion process. Some of the research data we looked at was terrestrial plants.

The ranges that we are talking about are in the range of—for other than kelp—are in the range of 3 to 3½ standard cubic feet of all solids. Under steady state conditions through the last 2 years, operating at the 10-liter scale, we have achieved over 4½, close to 5 standard cubic feet per pound of solids using macrocystis. That is the only kind of seaweed that we have been running any experiments on to date.

Mr. STUDDS. What about with respect to your statement that preliminary studies indicate gas costs would be competitive with other SNG sources?

Dr. FLOWERS. The preliminary estimates that we have made indicate that gas costs range from about $3 to $6 a million BTU.

Mr. STUDDS. That is for kelp?

Dr. FLOWERS. For kelp, yes, sir.

Mr. STUDDS. How about comparative costs of other sources?

Dr. FLOWERS. For instance, SNG from coal would range on the order of about $5 to $6, intermediate Btu gas would range from, say, $4 to $6, of that nature. It is in the same ball park as other alternative sources of energy.

Mr. STUDDS. Synthetic?

Dr. FLOWERS. Yes, sir.

Mr. STUDDS. Mr. Forsythe.

Mr. FORSYTHE. In your statement you referred to continuous fertilization to secure the maximum growth from the kelp.

What type of fertilization do you do in this kind of a process? Chemical fertilization?

Dr. FLOWERS. No; we upwell, mechanically upwell deep ocean waters. From about 500 feet on down, the nutrients in the ocean begin to increase with depths to about 1,500 to 2,000 feet where it begins to level off. It is according to the ocean currents, but those

deep ocean waters contain large amounts of nutrients. If you upwell those to the plants, it provides excellent fertilization.

Mr. FORSYTHE. Is that basically done with the curtain, chimney effect rather than pumping?

Dr. FLOWERS. We do it on the test farm using diesel pumps to pump it up and in a commercial system we visualize using wave power pumping systems which would require no energy at all, and this is one of the program plans. In fact, there is some initial work underway.

Mr. FORSYTHE. Have you proposed any numbers on net energy input and output with this kelp development?

Dr. FLOWERS. The net energy studies that we have done, General Electric has done for us inhouse indicates about a 70-percent efficiency and if we substitute wave power pumping for diesel power pumping, that could be increased, we think, to about 80 percent.

Mr. FORSYTHE. I think you stated that there are no environmental impacts, is that correct?

Dr. FLOWERS. No, sir, I did not mean to imply that, sir. We do not feel like there are any major environmental impacts. We know that there will be some which we will have to take care of but we do not think there are major obstacles.

Mr. FORSYTHE. How about fish, what does it do to the fish?

Dr. FLOWERS. As it turns out, kelp beds are one of the best havens that fish have ever found. Matter of fact, a good amount of the ocean, of the fish farming off the California coast is the kelp beds. The fish just love the kelp.

Mr. FORSYTHE. Is this going to disrupt the fish harvest if this is done on a massive scale?

Dr. FLOWERS. No; we think it will increase it very much. We think it will increase the fish population and increase the harvestable fish.

Mr. FORSYTHE. Have you run into any governmental problems in terms of permits or regulations that are going to be problems down the road?

Dr. FLOWERS. I cannot actually answer that question. The governmental bodies that we had to check with to get the test farm in the water to allow that, all of those bodies that we checked with were all very positive and very cooperative. Frankly, way downstream when you are talking about very large scale streams, I do not think it is our own governmental body that we need to worry about so much than some others.

Mr. STUDDS. Could you supply us for the record with a list of those governmental agencies at all levels of government in which you did or had to consult in order to do that?

Dr. FLOWERS. Yes, sir, I would be happy to do that.

[The following was received for the record:]

GENERAL ELECTRIC CO.,
REENTRY & ENVIRONMENTAL SYSTEMS DIVISION,
*Philadelphia, Pa., October 3, 1979.*

GAS RESEARCH INSTITUTE,
*Chicago, Ill.*
(Attention of Dr. Ab Flowers, Director, Gas Supply Research).

DEAR AB: Attachment A to this letter provides the data requested by the House Subcommittee on Oceanography asked during your testimony on September 26th. I

hope this provides the information you needed. Please feel free to call me if you have any additional questions.

Best regards,

ALAN N. TOMPKINS,
*Program Manager, Marine Biomass Program.*

Attachment.

ATTACHMENT A TO LETTER TO DR. AB FLOWERS

NO. GE-810-554

Approval for deployment of the Marine Biomass Program's Test Farm off of Laguna Beach, California was granted by two Federal agencies with jurisdiction as follows:

1. U.S. Corps of Engineers granted approval for the placement of this structure under authority granted to them under Section 10 of the Rivers & Harbors Act dated March 10, 1899, 33 U.S.C. 403 stipulating performance of work in or affecting navigable waters of the U.S.

2. Permit from the U.S. Coast Guard was required identifying the Test Farm as a private aid to navigation. This permit was issued after the U.S. Coast Guard's approval of appropriate drawings and specifications specifying necessary markings, navigational lights, and hazard warning systems.

Mr. FORSYTHE. I see another 200 mile zone for kelp beds.

Mr. Chairman, I think I should desist. I appreciate the opportunity. Thank you very much.

Mr. STUDDS. Mr. Emery.

Mr. EMERY. Thank you, Mr. Chairman.

I wonder if you could tell us a little bit about the process by which the gas can be manufactured from kelp? There are three processes that I am aware of that are generally used to producing energy from biomass. One is pyrolysis, the other being fermentation process, and the third anaerobic digestion.

Can you tell me a little bit about the feasibility of each of those methods and why you selected the one that you selected?

Dr. FLOWERS. We selected anaerobic digestion as being by far the best process for the conversion of the kelp to SNG because, No. 1, anaerobic digestion allows a liquid base, if you will, as it turns out, all we have to do to the raw kelp is just grind it and put it in the digestor. The saltwater in the kelp is just about the right amount of water that we need in a digestor in operation so we do not have to add additional water. Fresh water is not required. The bacteria that we have modified from the sewage and developed from marine sources thrive in the saltwater environment so it is just really a natural for that purpose.

Mr. EMERY. What is the byproduct, what is left over after the digestion process? Is it waste material, or something that could be used as fertilizer, in addition to any other traits?

Dr. FLOWERS. There are both liquid and solid effluents from the digestion process. Both of these could be processed, to feeds and fertilizers, and to food supplements, or it could be returned back to the farm, to save those nitrates and nitrites for additional fertilization on the farm, and thereby reducing any upwelling requirements that we have in the deep ocean waters.

Mr. EMERY. I asked the question because I wonder if we are going to get into a disposal problem for the material which remains after this process. Many, many other processes that we are familiar with have useful byproducts, but if it is a system that is going to require ocean dumping, or some other disposal mechanism, that is going to cause a problem, we ought to be aware of it. Do you see any problem of it being marketed as a feed, or as a fertilizer of

some kind. Or is there some problem about that we do not know about?

Dr. FLOWERS. One of our General Electric subcontractors, the U.S. Department of Agriculture, Western Research Center in Albany, Calif., is working on this very problem for us, taking protein as food and feed, and fertilizer.

Mr. STUDDS. Those are the second bells for the vote on the floor. We will resume in 10 minutes.

[Short recess.]

Mr. STUDDS. The subcommittee will resume, and Mr. Emery, you may resume.

Mr. EMERY. Thank you very much.

Before the vote, we were discussing the process from which fuel can be made from kelp, and we were discussing the disposal problems.

I wonder if you might reflect a bit on the problem of salt content in the use of residue for a feed, or agricultural fill?

If you have a heavy supply, or heavy concentration of ocean salts, it could become a problem for agriculture, and the feeds.

Mr. TOMPKINS. The primary salt in the kelp is potassium chloride, which we are told by people at USDA could be a useful element in fertilizers.

Now again we are also considering the option of returning the solid and liquid effluents to the ocean, primarily to take advantage of the nitrogen as it passes through the process.

Mr. EMERY. Would that material be a suitable food supply for kelp growers?

Mr. TOMPKINS. Yes. We have done some analyses, which suggest if we return the nitrogen, that is contained within the kelp plants, and passes through the digestion process, back to the farm, it could reduce our upwell requirement by about 20 percent. So it is a significant consideration to be examined in detail in the future.

Mr. EMERY. I asked the previous witness questions as to the feasibility of using different kinds of kelp as opposed to another. Have you been able to do any experiments, comparing the use of different kinds of kelp, other than the giant kelp that you have done your work with, and if you have, is there any significant difference in the supply of methane from the fermentation, or rather the digestion process?

Dr. FLOWERS. We have done no work on this, except macrocystis, downstream we intend to check other varieties of kelp, as well as start work this coming year on other species of seaweed, to check the production of SNG, or methane from those species, as well.

Mr. EMERY. Do you have any reason to believe that the results are going to be substantially different, either better, or worse, not taking into account the cost of convenience of harvesting?

Dr. FLOWERS. It all depends on the chemistry of the plants.

Mr. EMERY. Do you know how much that substantial difference is in the chemicals of the various algaes? They are in the same structure, but only in different biological forms, is that right?

Mr. TOMPKINS. Let me try to answer that. The main refractory elements, the chemicals within the macrocystis that are biodegradable are algae, some cellulose. We have a lot of data on the rates in which each of those refractory elements can result in gas.

For example, while one considers a kelp that has carrageenan in it, I do not have any data on how fast that chemical might revert through the hydrolysis step, and the—into methane. That will be one of the things that should be looked at in the future, and this may be part of other programs that we will be addressing on seaweed.

So the question, to emphasize what Doctor Flowers said, depends on the chemistry of the plants, some of the chemicals may go more rapidly than others, higher rate, obviously, which has an impact on the economics. Some may go more slowly. It is too early to project.

One can build some kinds of models that one can predict the rate at which these things go, but the only way is experiments, starting on a small scale, perhaps one liter, and then 10 liters, and then building up, if the data is positive.

I do not mean to lean on your arms but it is chemistry dependent, and one has to get at it experimentally. The microbiologists are hard pressed to predict the rates at which some of these chemicals can be converted to methane.

Mr. EMERY. I would suppose the ultimate desirability of any species would depend on not only the general chemistry, but the rates of growth, and other characteristics that would relate?

Mr. TOMPKINS. That is precisely right, you have to consider the balance of the whole system. Although it looks as if the feedstock cost is the greater of the two, that is to say the feedstock cost, and conversion cost, when one considers an integrated system, one has to look at both sides of the equation, how fast can you group it, productivity, and the subsequently, how fast, and how much gas can you get out of a pound of it, or a ton of it, that you put into your processing system. So you cannot consider that independently.

Dr. FLOWERS. We also plan to look at the genetics of the species to see if there is anything that we can do there.

Mr. EMERY. What can you tell me about the distribution of nutrients in the ocean, obviously that the water temperature is a bit warmer at the surface than at the depths, and I suppose that the growth of seaweed is going to have to occur in the top layer of the water so that the photosynthensis will be maximized.

Can you give me some idea of the natural distribution of the nutrients in the ocean. Is it possible that you might be able to group these seaweeds and kelp in a depth where the nutrients and the photosynthesis reasonably are in balance so that you could eliminate the pumping of the water from the depths?

Have you experimented with that or do you find that that is not feasible?

Dr. FLOWERS. The information that we have from Dr. Wheeler North of Cal Tech and from the references that he has, indicates that the oceans at a given depth, discounting mixing, are essentially about the same as far as nutrients. The surface of the ocean is nutrient bare, essentially none as you get down to 500 feet. The nutrients concentration increases beyond that. It seems to vary somewhat but it is of a general range of the same level. This in the Pacific depends on the mixing of the Arctic Oceans and the Antarctic Oceans as to just where you are there. But the oceans are nutrient rich.

Mr. EMERY. I guess what you are saying is that due to the fact that the nutrients are concentrated more on the depth than on the surface, you depend upon the flow of nutrients from the water which is really too deep to provide adequate photosynthesis?

Dr. FLOWERS. That is correct.

Mr. EMERY. All I am trying to get at is whether or not it is necessary to have some kind of a complicated pumping system, whether or not it is possible to grow these things in an area and eliminate that step by the energy consumption process.

Dr. FLOWERS. For instance, on the west coast of California, the kelp beds get fertilized about 3 months out of the year. Natural upwelling on the coastline. On the east coast, for instance, New Jersey, New York, and New England area, as I understand it, the water there for 100 miles out are nutrient rich. Mainly from wastes from the land. In some areas, as the river outcrops in the ocean, it is rich for that reason.

Nutrients are added to the ocean from runoffs from the land as well as from dying fish and seaweed and things like that in the ocean itself.

Mr. EMERY. Also, there is a great deal of water table and water motion which results in a more thorough mixing than you might find in other places.

Dr. FLOWERS. That is right.

Mr. EMERY. One other question. Have you had an opportunity to compare the cost of the synthetic methane made from seaweed to natural gas? Natural gas price now depending on who you buy from may be $2.25 per thousand cubic feet. Have you cost compared it?

Dr. FLOWERS. We would not be cost competitive with natural gas. We would be with other forms of synthetic gas, and that is the whole key.

Mr. EMERY. How much are we talking about in the cost comparison? Natural gas just picking a figure out of thin air is $2.25 per thousand feet. What is the comparable price?

Dr. FLOWERS. We said that our preliminary studies indicate a cost range from $3 to $6 a million Btu.

Mr. EMERY. So you would very definitely be competitive with other forms of synthetic fuel but not necessarily with the cost of petroleum natural gases as it occurs now?

Dr. FLOWERS. Not at the present time, no.

Mr. EMERY. Do you anticipate, as your technology proves and as the petroleum derivative natural gas increases, that it will be a reasonably short time before you will be cost competitive? Do you anticipate that you will be considerable time reaching that point?

Dr. FLOWERS. Well, on the present master plan for this program, we anticipate having a good indication of what the technical and economic feasibility of the program will be about 1983 to 1985. On our present schedule, we do not anticipate having a commercial prototype system in operation until the late 1990's. Now, that program could be speeded up if necesary to do so in the present slow situation that we are undergoing today, that is the present schedule. Whatever costs we come up with, it does not mean anything.

Mr. EMERY. Do you expect that the economics of scale is going to have something to do with the cost?

Dr. FLOWERS. Yes, sir.

Mr. EMERY. Do you think when you have a commercial scale that the cost will drop commercially?

Dr. FLOWERS. We believe that a larger scale is certainly more cost effective than a smaller one. A small one would not be cost effective, and an integrated system is the most cost effective.

Mr. EMERY. You have testified about a very interesting project and I wish you all success. I do want to ask you a couple of other questions relating to other terminologies to determine whether you have looked at them or if you have any interest or desire of pursuing them.

Specifically using municipal solid waste, or any solid waste or gas recovery or sewage.

Have you looked at those alternatives?

Dr. FLOWERS. Yes, we have to consider doing that as a separate individual project. We have elected at this time to put the majority of our dollars, of course, in the marine farm program.

However, there is a project currently underway at Disney World which is funded by EPA and Walt E. Disney Productions. We have looked at that. We have given a proposal to WED for involvement of GRI in that program, of which we would first take the sewage sludge that is produced at Disney World and optimize its conversion to methane.

We would take the water hyacinths that they are presently using to clean up the secondary effluent of that system and convert that to methane, and then we would try mixtures of those two to try to optimize it.

Also, the University of Arizona is enriching the water hyacinth using $CO_2$. So we would plan then to look at the $CO_2$ product coming out of the digester along with the methane to check its recycle value to the water hyacinth to increase productivity.

So, yes, we have given them a proposal on that. We hope it will be acted on favorably and that we will be involved in that by as early as next month.

Mr. EMERY. Just as an editorial comment, I would say, as I am sure you are very much aware, we have a massive problem in this country with waste disposal, whether it is liquid waste from a sewer system or solid municipal waste.

It has just occurred to me that if we could ever find a way to utilize that tremendous waste material as a resource, find a way to recover potable drinking water from it, or to recover useful energy, or industrial chemicals or whatever we would find that our ability to handle the waste problem and ability to supply some of our other needs would be very much enhanced; I personally would encourage you and others who are interested in this particular arena to spend a lot of time studying the feasibility of various alternatives. I hope to see you here sometime in the not too distant future with another project wherein you solve some of our ocean dumping problems and waste disposal problems for us. I think that would be welcomed with open arms.

I thank you very much for a fine presentation and appreciate your coming here today.

Mr. STUDDS. Does the gentleman think we ought to involve Walt Disney more deeply in energy, or does he think that he has been primarily involved in it for some time?

Mr. EMERY. As a longtime fan of Mickey Mouse and Donald Duck, I can say that it may well solve some of Walt Disney's problems.

Mr. STUDDS. Or it may account for some of ours.

Mr. EMERY. It may account for some of ours, right.

Mr. STUDDS. Mr. Hughes, do you have any questions?

Mr. HUGHES. Thank you, Mr. Chairman.

I just wonder if, Doctor, you could tell me what is the process of bringing deep sea water up to the surface? What does that accomplish? I understand part of the reason is because of the nutrients involved in the deep water.

Dr. FLOWERS. The only reason is to bring the deep ocean nutrients up to fertilize the seaweed, yes.

Mr. HUGHES. Has that been perfected, the rate of flow, where you receive maximum growth?

Dr. FLOWERS. No, sir; that has not been perfected. That is part of our work right now going on in finding out just exactly how much upwelling is necessary to fertilize the farm. We are also beginning to work on wave powered pumping systems to replace the diesel power so it would use no energy to bring the water up.

Mr. HUGHES. Right now you are using diesel power to create a circulation, to bring the water up and circulation—you are displacing water in the vicinity of the seaweed

Dr. FLOWERS. That is correct.

Mr. HUGHES. It is just an expedient to get the project underway. I see.

Thank you.

Mr. STUDDS. Thank you very much, Dr. Flowers. I appreciate it.

Our next witness is Dr. John Ryther, senior scientist at the Woods Hole Oceanographic Institution.

Dr. Ryther and others who are waiting, we apologize for the slowness of these proceedings and their interrupted nature. It is almost inevitable.

Dr. Ryther, I apologize for greeting you on these grounds as opposed to your natural habitat in Woods Hole. No one should be subjected unnecessarily to this environment and we hope you survive it and get back there as quickly as possible.

## STATEMENT OF JOHN H. RYTHER, SENIOR SCIENTIST, WOODS HOLE OCEANOGRAPHIC INSTITUTION, WOODS HOLE, MASS.

Dr. RYTHER. Thank you very much.

[The following was received for the record:]

### TESTIMONY OF JOHN H. RYTHER

My name is John H. Ryther. I am a Senior Scientist at the Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, where I have carried out research in the fields of biological oceanography and marine ecology since 1951. My areas of specialization are biological productivity of the sea, marine aquaculture, waste recycling, and effects of pollution on marine ecosystems.

For the past five years I have conducted research under contract with the U.S. Department of Energy on the production of aquatic plants as biomass sources for conversion to fuel. In connection with that research, I have recently prepared a manuscript entitled "Fuels from Marine Biomass" that will be published later this

year in the Woods Hole Oceanogrpahic Institution's publication Oceanus. The following remarks have been taken from that manuscript.

Of the various existing and proposed methods of utilizing solar energy, the production of fuels from new, photosynthetically-produced organic matter—"biomass" in the current terminology—is, at once, one of the simplest and most complicated. The technology itself is simple. Dried plant biomass may be burned directly. That, indeed, is man's original source of energy, and firewood is still a familiar fuel in much of the United States—one that appears destined to revive in its importance and significance.

But plant biomass must be relatively dry for direct combustion. Unlike seasoned wood, most freshly harvested plant material contains 85–95 percent water which cannot be easily or economically removed and which may cost more in energy for its removal than the energy content of the final product.

An alternative method for obtaining power, or at least fuel, from wet plant biomass is that of anaerobic digestion. Sugar plants (cane, beets, sorghum) and grains, particularly corn in the United States, have a distinct advantage in this respect because much of their biomass is directly fermentable to liquid fuel, ethanol. Some U.S sugar crops are already contributing to the production of "gasohol". However, careful analyses of the existing technology for producing corn and converting it to ethanol indicates a negative energy output-input balance, so the prospects of fuel production from this source would appear to be limited to the use of sugar crops from the limited area in the U.S. where they may be grown.

Virtually all wet plant biomass also readily undergoes a more complete anaerobic decomposition or fermentation, with the ultimate production of gas that is a mixture of carbon dioxide and methane. The gases produced from such anaerobic digestion have heating values of 500–800 Btu per standard cubic foot and can be readily upgraded to pipeline-quality gas by established processes.

The difficulty with all of these approaches lies in the fact that vast quantities of biomass are needed to make a significant contribution to the U.S. energy budget. The energy content of most organic matter, including seasoned firewood, is in the range of 20–30 million Btu per dry metric ton. The best yelds from short rotation silviculture are roughly 10 dry metric tons per acre per year. To provide the energy equivalent in firewood of a single 1,000 megawatt fossil-fuel or nuclear power plant would thus require a managed energy farm of the order of 100,000 acres, over 300,000 acres. (ca. 500 square miles) if that energy were in the form of electricity generated from direct combustion of the wood.

With respect to the anaerobic digestion of wet plant biomass, only about half of most organic matter is capable of being fermented to the above-mentioned low grade (50–60 percent methane) gas mixture. Agricultural crops, grass lands, and other forms of terresterial vegetation in continental U.S. are, on the average, less productive than the forest trees cited above. The mean annual yield of corn, the most productive temperate U.S. crop, is no more than 5 dry tons/acre including residues (about 45 percent of the total plant biomass). About one billion acres in this country are presently used for the production of 1.2 billion tons of grains and grasses—an overall average of just about one ton per acre per year. The energy potential of these relatively low yields, converted to methane by the rather inefficient process of anaerobic digestion, means that some 200 million acres of cropland would be needed to produce just one quad ($10^{15}$ Btu) of energy, about 1 percent of the projected U.S. energy budget for the year 2000—that being the gross output uncorrected for the energy input for growing, harvesting, tranporting, processing, and fermenting the biomass and for upgrading, transmitting and/or storing the product gas. Such an area is roughly 20 percent of the total now in use in the United States for agriculture and grazing and twice the area that has been designated as unused, available cropland.

Not only do the above areal requirements appear to be unreasonably high for either economic or energy-based cost effectiveness, but the more important consideration is that good agricultural land available in the United States—that capable of producing even the modest agricultural yields discussed above—is already almost fully in use for the production of food and fiber crops that, for the most part, are worth 10 to 100 times the value of the corresponding biomass for fuel. Even at a deregulated price of $5.00 per thousand cubic feet, the amount of methane that could be produced by anaerobic digestion from one ton of a typical agricultural crop would be worth no more than about $25.00, roughly one cent per pound.

In short, with the exceptions of wood and certain agricultural wastes, that may be burned directly, and a few special crops, surpluses of which may be converted directly to liquid fuel, the conventional agricultural crops, grasses, and other forms of terrestrial vegetation do not appear to hold much promise as a major source of U.S. energy.

Does the general "fuels from biomass" concept, then, have any validity and, if so, what kinds of biomass could conceivably be grown for that purpose? It would appear, not only that species not presently cultivated must be grown for this new purpose, but also that they must be grown in areas not suitable for the cultivation of food and fiber crops. They must also be highly productive and they must be easy and inexpensive to grow, harvest and process to a form suitable for their digestion to methane.

The seaweeds would appear to fit most of these requirements. Certainly the oceans are the largest uncultivated and under-utilized pastures on earth. Some species of seaweeds do have commercial value as food, in eastern countries, and for their contained chemicals, but most have no commercial value and some (e.g., sea lettuce) are considered esthetic nuisances when they grow or accumulate to high densities in heavily-populated bays and estuaries. In general, cultivation of seaweeds for energy would not compete for production of food or fiber crops in terms of space, effort or economics.

A few of the seaweeds used as food have been cultivated for a number of years in Southeast Asia and the Orient, and, more recently, some of those used for their chemicals have been grown, though that industry still relies primarily on the harvest of natural populations. Cultivation of the food species has, for the most part, employed intensive labor practices and a rather primitive technology. Yields from such practices range widely, from less than one dry ton per acre per year for the highly prized *Porphyra* or "nori" in Japan (whose price of more than $20 per pound justifies this high labor-low yield activity) to the more impressive 20 tons/acre/year for kelp grown in Northern China. The latter rivals the more productive terrestrial crops such as napier grass and sugar cane, experimental yields of which in Puerto Rico have recently been reported at 26 and 22 dry tons/acre/year respectively (mean annual sugar cane production in mainland U.S. and Hawaii, including total dry matter, are 10 and 16 tons/acre respectively). Seaweeds grown for their chemicals in Japan, Taiwan and the Philippines have intermediate yields averaging about five dry tons per acre per year, the same as the mean production of corn, including residues, in the United States.

The present author first grew seaweeds at the Woods Hole Oceanographic Institution as part of a waste recycling-aquaculture project in which the plants were used as a polishing stage to remove the nutrients generated by a shellfish culture system prior to discharge of the aquaculture effluent to the environment. When ERDA, precursor of the U.S. Department of Energy, developed its "Fuels from Biomass" program in the mid-1970's, the search began for highly-productive plant species that could be grown over vast areas as "energy farms" capable of providing the organic biomass needed to make a significant contribution to the country's energy needs—then pegged at some 75 "quads" (quadrillion or $10^{15}$ BTU) per year and estimated to exceed 100 quads by the turn of the century. Because of the promising preliminary results with seaweed culture in the Woods Hole aquaculture project, support was obtained to investigate the potential of seaweeds as a "biomass for energy" source. At that point, the research was transferred to the Harbor Branch Foundation laboratories in Fort Pierce, Florida because the milder climate and more abundant sunshine of that location would permit year-round growth of the plants and thereby better reflect the maximum potential of seaweeds for organic production.

Over 50 species of seaweeds native to Florida coastal waters, including representatives of all of the major taxonomic groups—green, red and brown algae—were screened in small outdoor culture units to select the most promising species with respect to growth rate throughout the year and the relative freedom from difficulty of its cultivation. The best of the lot, by these criteria, was the red seaweed, *Gracilaria tikvahiae.*

*Gracilaria* was then grown throughout an entire year under what appeared to be ideal culture conditions—vigorous aeration, rapid exchange of enriched seawater, frequent harvest, with an annual production that averaged 35 grams dry weight/$m^2$/day—equivalent to 51 dry tons/acre/year.

It is, of course, misleading to extrapolate small-scale experimental results to large areas where scaling factors and other complications may lead to significantly lower yields. However, the productive potential of many terrestrial crops have been evaluated in similar, small-scale experimental plots. None has surpassed that of *Gracilaria* in the above experiment. It must be remembered, however, that *Gracilaria,* like other seaweeds, contains a large fraction of its dry weight as mineral salts. Ironically, the more ideal the culture conditions, particularly with respect to the supply of essential nutrients, the greater the mineral or "ash" content of the plants, those grown in the experiment described above having an ash content of approximately 50 percent of its total dry weight. But the purely organic yield of 25.5 tons/

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acre/year still exceeds that of almost any other plant on earth for which there is well documented evidence, the only possible exceptions being the best yields of sugar cane grown in the tropics, the freshwater weed, water hyacinth, and perhaps a few tropical grasses.

*Gracilaria* is grown commercially in southern Taiwan, in shallow ponds averaging 25 acres in size that were originally constructed for fish culture. The seaweed is grown on the bottom of the ponds that range from one-quarter to one meter in depth, depending on the season. Water in the ponds is exchanged sporadically with the adjacent estuary, at intervals of days to weeks as needed to control temperature and salinity, but the water is usually not enriched. The seaweed is harvested seven or eight times a year by dip-netting a portion of the plant population from the pond and spreading the remainder evenly over the pond bottom.

This relatively passive, non-intensive culture technique results in a yield of about five dry tons per acre per year, only 10 percent of that achieved in Florida. Thus it would appear, as a rule to thumb, that the more intensive the culture system, the higher the yield. Attempts are now being made to develop a culture system that is a compromise between the low-cost, low-energy-input, passive Taiwanese technology and the intensive Florida system and that may result in yields intermediate between the two that would be cost effective but could still be impressive relative to plant biomass production elsewhere.

Equally important, however, is the development of a culture method whereby the plants can be grown offshore in the open ocean. Since seaweeds normally grow attached to the bottom, they are restricted in their natural distribution to the shallow fringes of the sea, in depths of water never exceeding 100 meters and usually in less than 10 meters. The few culture operations are similarly restricted to shallow coastal waters or to impoundments on land, as in the Taiwanese *Gracilaria* industry. But coastal lands and waters are among the most costly and heavily used parts of our country. If prime agricultural land is in heavy demand for food production, the coastal zone is in even heavier demand for that and almost every other form of human activity including industry, housing, recreation, transportation and waste disposal, among others, many of which are already in confict with each other. Large-scale energy farming could not possible compete with these other multiple uses of coastal lands and waters. Rather it would have to be conducted offshore in the relatively inaccessible and little used parts of the oceans. This immediately imposes a host of new problems, both technical and economic. New methods must be developed for growing seaweeds offshore, at or near the sea surface, within the relatively shallow depths where there is sufficient light for photosynthesis, in trays or baskets, or nets, or woven into ropes, in or on some type of structure that is moored or suspended in such a way as to withstand normal waves and currents and ocean storms.

Preliminary experiments have been initiated in Florida to develop such techniques for offshore culture of *Gracilaria,* but perhaps, in the long run, some other species of seaweed will turn out to be better adapted to cultivation in the open sea. The ubiquitous brown alga *Sargassum* is a logical candidate, since it occurs naturally in the central gyres of the oceans, where it lives at the sea surface, buoyed by small floats or bladders. Such a floating habit is an obvious advantage to open ocean culture, eliminating the need for costly suspending structures or devices. One species, *S. natans,* which gives the Sargasso Sea its name, grows only vegetatively, never having been known to produce or bear fruiting, reproductive bodies. Unfortunately, the evidence to date indicates that the drifting species of *Sargassum* grow very slowly, but more work needs to be done with that otherwise promising genus.

Another very attractive candidate for offshore marine biomass production is the giant kelp *Macrocystis pyrifera* [1]. This large alga, which may reach 50 meters or more in length, is one of the most important resources of the California coastline, not only for its own commercial value, but also as the dominant species and habitat of the local ecosystem.

In the mid-1970's an ambitious Ocean Food and Energy Farm (OFEF) Program funded jointly by ERDA, NSF, the American Gas Association (AGA), the U.S. Navy and various organizations in public and private sectors was begun. The primary objective of the farm was to cultivate kelp as a source of energy. An ocean farm system was designed under the management of H. O. Wilcox of the Naval Undersea Center, San Diego and production costs and performance of the system were estimated.

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[1] The section on giant kelp is taken from a special topical report on sources and systems for aquatic biomass as an energy resource by E. H. Wilson, J. C. Goldman and J. H. Ryther, which is part of the cost analysis of algal biomass systems by Dynatech R/D Company referred to later in this article. It is based on material provided by Prof. Wheeler J. North, California Institute of Technology.

The design consisted of an open ocean farm covering 100,000 acres, 12.5 miles on a side, located 100 miles off the coast of Southern California. Following site survey studies, 3 sites in Southern California were recommended. The farm substrate, maintained at a depth of 34 meters was to be made up of flexible triangular moduls, 1,000 feet on a side each covering about 10 acres. Each module would be held in place by diesel-powered propulsors. Nutrient-rich water was to be upwelled from a depth of about 91 meters by wave-powered pumps.

Kelp plants, attached to the substrate at a density of one plant per 34 square meters, would take about 4 years to mature and then the standing crop would be harvested by a harvesting ship six times per year. The estimated yield of the farm was about 15 dry tons/acre/year of which eight tons would be organic biomass. In comparison, the productivity of natural kelp beds is estimated by Dr. Wheel North and others as 1–2 tons/acre/year.

To test the technical and economic feasibility of the commercial-sized ocean energy farm, a research program was initiated in 1976 jointly sponsored by ERDA (subsequently DOE) and the American Gas Association and managed by the General Electric Company. Scientific and engineering support is provided by the Institute of Gas Technology, the U.S. Department of Agriculture and Global Marine Development, Inc. Under this program a quarter acre module (QAM) of the sea farm was constructed at a site off Laguna Beach, CA. The QAM consisted of 8′ diameter buoy which stands upright in the water and is attached by a swivel joint to an umbrella-shaped set of radial arms to which kelp plants are attached. Nutrient-rich water is pumped up through 2′ diameter fiberglass pipe using 3 pumps of 3,300 GMP driven by a 35 HP diesel. The test farm was deployed at sea in 1978, and soon thereafter was seeded with juvenile kelp plants, but due to a number of technical problems, the initial plantings failed to survive. A second test of the experimental system was in preparation at the time this article was written. In the meantime, a DOE-sponsored engineering and economic analyses of a number of proposed aquatic biomass energy farms, including both freshwater and marine species and unicellular algae as well as seaweeds and higher plants, carried out by Dynatech R/D Company of Cambridge, MA cast some considerable doubt on the cost-effectiveness of the proposed kelp farm both with respect to economics and the energy input:output ratio.

Seaweed culture as a large-scale commercial operation is still very much in its infancy. The few practices scattered around the world are, for the most part, primative and make little use of modern technology. Much remains to be learned about the basic biology of the plants, particularly with respect to their nutrition and growth and factors that control their organic productivity. The much more difficult task of developing a technology for growing seaweeds in the open sea must await our ability to grow them in small, controlled experimental units on land or in protected coastal areas, and to fully understand and define their growth potential under different conditions. In short, open-ocean energy farming of seaweeds must be regarded as a long-term prospect that cannot be expected in a time frame of less than tens of years.

It would be a serious mistake to neglect the challenging potential of producing biomass from the open sea. But it would be equally wrong, in my opinion, to plunge headlong into large-scale and costly experiments in this area where so much fundamental science and technology remains to be done. Repeated failure of such hastily conceived efforts will lead inevitably to the premature elimination of open-ocean energy farms from further consideration. That would be unfortunate, because the ocean is just about the only place on earth where truly large-scale biomass production, capable of contributing significantly to the world's energy budget on a non-competitive basis with man's other space needs, could conceivably be carried out.

*High-yielding terrestrial and aquatic crops*

[Units in dry weight tons per acre per year]

| | |
|---|---|
| Experimental (small scale, maxima): | |
| Sugar cane (Puerto Rico) | 22 |
| Napier grass (Puerto Rico) | 26 |
| Water hyacinth (Florida) | 35 |
| *Gracilaria* (Florida) | 52 |
| Commercial (large scale, average): | |
| Silviculture (U.S.) | 10 |
| Sugar cane (Hawaii) | 16 |
| Sugar cane (Mainland U.S.) | 10 |
| Corn (U.S.) | 5 |
| Kelp (People's Republic of China) | 20 |
| *Gracilaria* (Taiwan) | 6 |

[The following paper written by Dr. Ryther was submitted for the record:]

## Growth and Yield of Aquatic Plants

Farmers and ecologists are familiar with the concept of plant productivity or yield—amount of material produced per unit of area and time. Short-term yields are usually expressed as g/m$^2$.day, seasonal or annual crops as metric tons/hectare.year (or the more familiar, to many, British units of short tons/acre.year, which are 0.36 times the metric units). Ecologists interested in the comparative productivity of different kinds of plant species or communities usually express yields in dry weight, often in ash-free dry weight, which is to say the strictly organic fraction of the plant production.

Other botonists concerned with physiological processes of organisms think in terms of the specific growth rate of plants. This may be exressed as g increase/g.day or, more often, percent increase/day or doubling time in days.

Growth and yield are, of course, closely related, yield being the product of growth rate and plant density. But the relationship is not constant because growth rate is itself a variable function of density. This is illustrated for four quite different kinds of aquatic plants in Fig. 1. Original data were obtained for the marine diatoms, from Goldman and Ryther(1), for the red seaweed *Gracilaria*, from Ryther et al.(2), and for the two freshwater macrophytes, from DeBusk et al.(3).

The diatoms were grown in Woods Hole, MA in 2000 1 (2.3 m diameter 0.5 m deep) continuous cultures of seawater enriched with 2° treated sewage effluent. In steady state, growth rate was considered equivalent to dilution rate, density was measured as particulate organic carbon and doubled to give total ash-free dry weight, and yield calculated as the product of density and dilution rate. The diatoms were essentially monocultures of *Phaeodactylum tricornutum, Amphipora* sp. and *Amphora* sp. which succeeded each other as dominants during the course of the experiment.

The *Gracilaria* was grown in Fort Pierce, FL in 50–1 outdoor cultures in which the plants were suspended by aeration and through which enriched seawater was circulated at an exchange rate of 20 volumes/day. The culture was removed from the water, drained and weighed at weekly intervals. Ash-free dry weight was considered at 5.0 percent of wet weight. Density is expressed as the mean of the starting and final weight for each one week interval.

The freshwater macrophytes duckweek (*Lemna minor*) and water hyacinth (*Eichhornia crassipes*) were also grown in Fort Pierce, FL in 25,000 1 (30 m$^2$ area, 0.5 m deep) PVC-lined earthen ponds through which enriched well water was exchanged at one volume/day.

The water hyacinths were held in Vexar-mesh cages ranging in size from one to 2.3 m$^2$. At intervals of one week the cages with the contained plants were lifted from the water, allowed to drain, and weighed. Duckweed was grown loose in the pond. Each week, the plants were netted from the water, drained and weighed. Ash-free dry weights of *Lemna* and *Eichhornia* were considered to be 9.0 percent and 4.25 percent of wet weight respectively.

Yields of the three macrophytes are expressed as the mean daily increase in ash-free dry weight/m$^2$ for each weekly interval and mean growth rate for that interval obtained by dividing yield by mean density.

All of the above studies were carried out over a period of four to six months during late spring, summer and early fall. Growth rates and yields were at or near their annual maxima and are not typical or representative of average conditions throughout the year. However, the relationships between the three variables were subsequently found to be the same in winter as in summer.

In every case, growth rate decreased with increasing plant density. Yield, the product of the two, was greatest at an intermediate density. The reason for the decline in growth rate is not clear. It is tempting to invoke detrimental effects of overcrowding-self-shading, nutrient limitation, accumulation of metabolites, etc.—but the fact that the effect occurred equally at low as well as high densities makes such an explanation unconvincing. One can say only that the phenomenon appears to be a general characteristic of aquatic plants, possibly of all plants. The photosynthetic portions of both duckweed and water hyacinth are, after all, air-borne the same as terrestrial plants. Watson(4) obtained a very similar relationship between the yield of kale and its leaf-area index, a unit that is proportional to total plant density. Optimal yield was obtained at an intermediate leaf-area index above and below which it declined rapidly. Davidson and Donald(5) described a similar rela-

tionship in clover, and Kasanaga and Monsei(6) developed a numerical model to preduct optimal leaf-area index for maximum plant production.

The relationship described above is of considerable importance in the context of current research programs investigating the potential of plant biomass as a source of energy. The most sensitive factor in assessing the economic or energy cost-effectiveness of such biomass systems is that of organic yield. In that connection, growth rate is often confused with yield. Duckweeds, for example, have, due to their "phenomenal reproduction rate" been credited as being "more productive than terrestrial agricultural crops"(7) and able to "grow at least twice as fast as other higher plants"(8). But it may be seen in Fig. 1C that the highest growth rate of duckweed occurs at a very low density and that actual yields of the species are relatively low when compared to the better agricultural crops, grasslands, and forests (e.g., (9)).

The yields of food and fiber crops may be determined simply by weighing the seasonal or annual harvest. No such expedient is possible with plant populations that are not commercially grown and utilized. In order to assess the potential yield of such species there is no substitute to cultivating them throughout the year or growing season in either natural or experimental plots and harvesting and weighing the resulting crop. For species in mild climates that are able to grow continuously in a vegetative mode, such as all four of the examples shown in Fig. 1, it is necessary to harvest the new growth frequently enough to maintain the density of plants at or near its optimum for maximum yield, if the full potential of the species for biomass production is to be determined.

Such experiments are difficult and time consuming and tend to be replaced by simpler but more crude yield estimates. One such approach has been to measure the growth rate of a given species experimentally, in the field or laboratory, and to apply such growth rates to a measured or estimated density of a natural stand of the plants to obtain annual yield values. In some cases short-term growth rates have been used to calculate annual yields, thereby ignoring seasonal effects. This general approach has been used to estimate the annual production of several kinds of aquatic plants including rockweeds and kelps in Novia Scotia(10), giant kelp off California(11), seagrasses(12), and water hyacinths(13).

Reference to Fig. 1 clearly shows how the use of independent values of daily growth rate and density and extrapolation of the resulting daily to annual yields may result in greatly exaggerated projections. Using the maximum growth rates and densities for the seaweed *Gracilaria* and the freshwater *Eichhornia* as given in Figs. 1B and 1D, for example, would result in annual yield estimates in excess of 500 ash-free dry tons/ha.yr. Actual measured yields of small, experimental cultures of the two species maintained under the best possible conditions throughout the year in Central Florida were respectively 63 and 75 ash-free dry tons/ha.yr(2, 3).

To put these figures in perspective, the best commercial yields of sugar cane, the world's most productive agricultural crop, are roughly 63 ash-free tons/ha.yr(14). Commercial seaweed production ranges from about one ash-free ton/ha.yr from the harvest of natural beds of giant kelp off California to some 25 ash-free tons/ha.yr for the small kelp, *Laminaria japonica,* that is cultivated in Northern China(15).

Thus Wolverton and McDonald's estimate(13) of 154 dry tons (ca. 131 ash-free dry tons) of water hyacinths/ha. for a seven-month growing season in Mississippi, obtained from separate measurements of growth rate and density, must be considered as suspect. Also untenable is the projection, similarly obtained, of up to 262 ash-free dry tons of giant kelp/ha.yr from the ocean energy farm that is presently in the pilot-testing phase by General Electric Corp., under contract from the Gas Research Institute and the Department of Energy(16).

Such lavish estimates have tended to create an unrealistic opinion of the potential role of aquatic plants as a biomass source for energy. This could prove unfortunate, since many aquatic species are, in fact, comparable to the most productive terrestrial crops in their organic yields and do not need exaggerated projections to justify their consideration.

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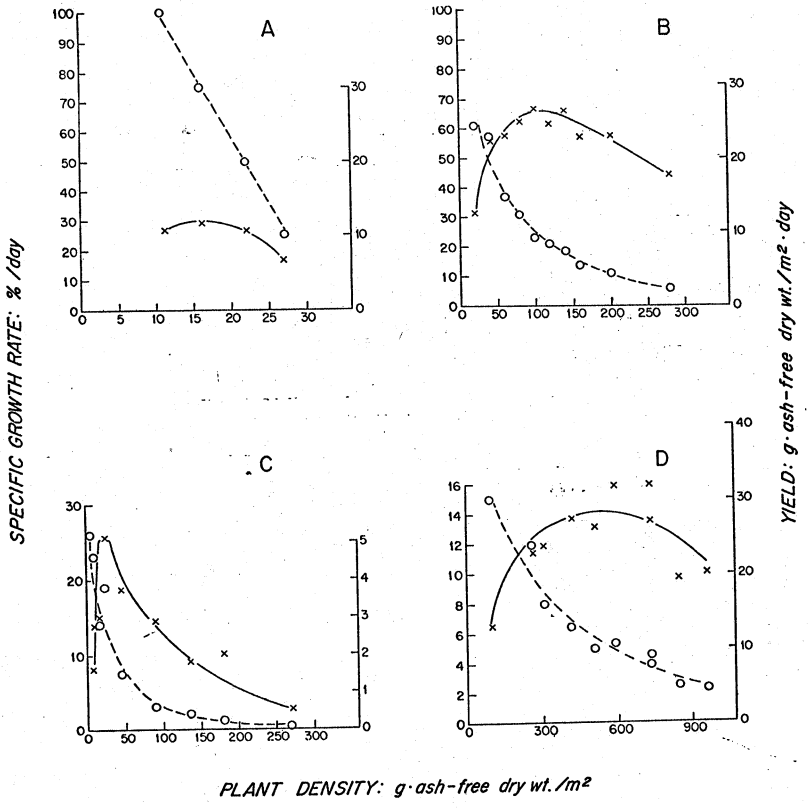



FIGURE 1. Growth rate (broken line) yield (solid line) of marine diatoms (A), the red seaweed *Gracilaria tikvahiae* (B), and the freshwater macrophytes, duckweed (*Lemna minor*) (C), and water hyacinth (*Eichhornia crassipes*) (D) as a function of plant density. Note that both horizontal and vertical scales differ for the respective species.

Dr. RYTHER. For most of my career I have been working at Woods Hole on problems of comparative productivity in yields of different kinds of marine and general aquatic ecosystems, and problems in aquaculture, marine aquaculture in particular, and problems of waste recycling.

I am trying to combine some of these things together, trying to use marine organisms as a method of removing the nutrients from waste water and growing useful crops and, at the same time, purifying the waste water and removing the nutrients from it.

For the past 5 or 6 years I have been conducting experiments along these lines in Florida at the Harbor Branch Foundation, a small private laboratory, working both with freshwater weeds, like water hyacinths, duckweeds, and so forth, and also with seaweeds.

When the Department of Energy "fuels from biomass" program then started up I found out about this and was able to get some support to look at the possible use of seaweeds and fresh water weeds as a biomass source for energy.

So I would like to talk a little bit about my experience there but try to put it first in some perspective and then begin perhaps considering some of the problems of biomass production on land in the terrestrial environment.

And it seems to me that there are two major problems with this. One of them is the tremendous land requirement for this. Considering, for example, trees for burning wood, which seems to be the most promising aspect of the fuels from biomass program at the moment. There is nothing new or startling about it. It has been going on for a long time but it does seem that renewed efforts in this area may prove profitable and there are new technologies for growing trees for this purpose.

Short rotation crops that can be cut off and the new trees will grow up from the roots. They are projecting yields and have, I guess, experimentally found yields of as high as 10 dry tons per acre per year from this. This dry wood is very high in its energy content, 30 million Btu's per ton or so.

In spite of these high yields and high energy content, to get a quad of energy from wood, if you were going to use it to generate steam in a conventional powerplant, it would take about 10 million acres—15,000 square miles, that is. It is a pretty sizable piece of real estate.

Other forms of terrestrial biomass, like sugar, which has been talked about today, that is certainly the most productive terrestrial crop in the world actually. In the continental United States the yields are a little lower than they are in places like Hawaii, but they average about 10 tons dry weight per acre per year.

If you were going to ferment that and make ethanol out of it, gasohol, again, it would take 44 million acres for 1 quad of energy. There aren't many places in the mainland United States where you can grow sugar.

The average production of terrestrial vegetation on land is about 1 ton per acre per year. That is agricultural crops and grazing grassland. According to the Department of Energy, this is about 1.2 billion tons produced over 1 billion acres of cultivated land.

That is not a very high yield, 1 ton per acre. If you fermented this and made methane out of it, which is perhaps the only thing you can do with most of these terrestrial that are essentially wet biomass, if you ferment it, which is also an inefficient system, it would take something like 200 million acres to produce 1 quad of energy. That is 10 percent of the area of the United States.

This is somewhat unrealistic, it seems to me, to be thinking about producing large quantities of fuel on land.

The other big constraint is the economic one. All of the best land available for this purpose is already in use for agriculture for food and fiber crops, and these are generally worth 10 to 100 times as

much as the equivalent value of the same amount of biomass for energy, even assuming a deregulated gas price value of $5, say, a thousand cubic feet.

Biomass is worth about 1 cent a pound as dry material. That means about a tenth of a cent is fresh weight and there aren't very many crops that are worth much more than that. So it seems to me that it is not realistic to think in terms of growing biomass for energy using materials that already can be used for food or fiber, nor does it seem reasonable to think that you can grow them on land that can be producing food and fiber crops.

Also, these energy crops would have to be highly productive and, I would think, of the order of 10 tons, at least, per acre per year. This would make them comparable to the best yields of land agriculture.

And, finally, they would have to be easy to grow and easy to grow in terms of the energy input. They would obviously have to have a positive energy balance.

I would submit that most of these requirements would be met by seaweed. Certainly, the oceans are the big unused pastures of the world and seaweeds do have some value as food in some parts of the world, and certain species of algae have value because of their chemicals, but these are limited.

These markets would be very quickly saturated so it would not be in competition for the food and fiber industry to produce large quantities of seaweed for energy, and they are productive.

Now, let me get into that business a little bit. There are some commercial seaweed culture operations going on around the world, not in the United States, but in the Orient in particular—China, Japan, Korea, Taiwan, the Philippines—the Philippines is where they grow it from marine colloids, one species—and a few other places.

The yields of these seaweeds—this is usually pretty primitive technology that is used in these countries but, nevertheless, quite effective. The yields are quite variable and they range from about 1 ton per acre per year in Japan, for example, to as high as 20 tons per acre per year in China where they grow a species of kelp, not the California giant kelp but a smaller species, Laminaria.

That 20 tons is quite an impressive number. There is one thing that I ought to point out right away and that is that the seaweeds contain a large quantity of ash or mineral matter and that doesn't do you any good as far as producing energy. So what we should be talking about is ash-free dry weight.

Seaweeds contain almost half of their biomass as ash from minerals, so you have to take this high yield of 20 and cut it in half as far as the yield of ash-free dry weight is concerned.

But, even so, 10 tons per acre per year for kelp in China is pretty good. That is comparable to sugarcane in mainland United States. It is as good as we can do on land. These other yields around the world is intermediate between those numbers of 1 and 20, or one-half and 10, if you are talking about the ash free yield.

The Fucuma, the seaweed that is grown in the Philippines now, and *Gracilaria,* another species that is grown in Taiwan, have yields of about 5 tons per acre per year total yield, total dry weight.

We have been looking at a number of different species in Florida. We screened about 50 local indigenous species to look for the one that looked best, that grew fastest and was easiest to grow, and ended up with one called *Gracilaria.* It is a red seaweed.

It also has the advantage that it contains the commercial polysaccharide agar, which gives it commercial value. The advantage of *Gracilaria* is that it will grow in Florida all year round. It stays in a vegetative condition. It never becomes reproductive. This is a big advantage. It just proliferates itself and breaks up into little pieces that you can continually crop it off and maintain it at its optimum density all the time, and this is an ideal situation for getting maximum productivity.

We were able to get a yield, in a small scale experimental system, of the equivalent of 52 tons per acre per year, which is very high. Taking the organic fraction, this would be half of that, 26 tons per acre per year. That is about as high as any documented yield for any plant on Earth.

The only things that are comparable to it are water hyacinths, which are extremely productive, and that was also the result of some of our experimental work in Florida. The best yields of sugarcane in the tropics, around 20, and there are a couple of tropical grasses that are comparable to this.

The last page of my testimony shows some of these high yields. You have to be a little careful of these data because, again, these are the total dry weight yields. I have not tried to show ash free organic matter because this is not given for a lot of the terrestial crops, so I didn't want to guess that.

But you can see from this that the aquatic plants, the *Gracilaria,* the kelp and so on, are up as high as most of the terrestial plants, either on a small experimental scale or on a large commercial scale as well.

This same *Gracilaria* that we are growing in Florida is grown commercially in Taiwan in large ponds about 25 acres in size and 3 feet deep that were designed originally for growing fish. The people have found that they can make more money by growing *Gracilaria.*

They get yields that are much lower than we get in Florida, a tenth as high. Instead of 25 ash free tons per acre they get about 2½. They do it in a very simple manner. They just let the seaweed sit on the bottom of the pond and grow by itself and when it is grown up a bit they harvest some of it out and spread the rest of it around and let it continue to grow.

Our rule of thumb as a result of this and some of our own work is that the more energy you put into the system the higher the yield you get, and somewhere there is an optimum with respect to the energy balance. This is what we are now going to be trying to find out, where in this system do you get the best energy output relative to energy input. This is something we have got to find in the next year or so.

But, equally important I think, is, having found the potential for these plants we have got to begin developing technology for growing them out in the open ocean. I think it is unrealistic to think that one could grow these on a large scale in our coastal areas, or on land along the coast. This is some of the most valuable land

with so many conflicting uses already that I think it is out of the question that this could be used for large scale energy farming.

I think one would have to get offshore into areas that are not now being used to carry this out. And this immediately opens up a whole new spectrum of problems, technological and economic. They are going to be very difficult problems.

We are trying to develop techniques by which we could grow this *Gracilaria* offshore using different kinds of suspending mechanisms for holding it up into the surface areas.

But it may well turn out that some other species of seaweeds are better adapted for this sort of thing, and you have just heard of one of these candidate species, the giant kelp. There may well be others. One of the more intriguing ones, I think, is Sargassum, which is a brown seaweed that already occurs naturally out in the central gyres of the ocean. It is the seaweed that gives the Sargasso Sea its name.

It floats because it is buoyed up by little bladders. There is a species that is the common species in the Sargasso Sea that remains vegetative throughout its whole life. It has never been found to have reproductive bodies, so it has that advantage as well.

We know almost nothing about this species. Nobody has really tried to grow it yet. This certainly bears looking into.

So I think the real challenge is can we develop a technology for growing these seaweeds out in the open sea where there is plenty of room and where we can take advantage of their natural inherent high growth rates.

I would like to end up by reading the last page or so of my testimony.

Seaweed culture as a large-scale commercial operation is still very much in its infancy. The few practices scattered around the world are, for the most part, primitive and they make very little use of modern technology.

Much remains to be learned about the basic biology of the plants, particularly with respect to their nutrition and growth and the factors that control their organic productivity. The much more difficult task of developing a technology for growing seaweeds in the open sea must await our ability to grow them in small, controlled experimental units on land or in protected coastal areas, and to fully understand and define their growth potential under different conditions.

In short, open-ocean energy farming of seaweeds must be regarded as a long-term prospect that cannot be expected to be solved in a time frame of less than tens of years I estimate.

It would be a serious mistake, I think, to neglect the challenging potential of producing biomass from the open sea. But I think it would also be equally wrong, in my opinion, to plunge headlong into large-scale costly experiments in this area where so much fundamental science and engineering technology still remains to be done.

I think that repeated failures--this is my major concern—of hastily conceived efforts will inevitably lead to premature elimination of this whole concept of open-ocean energy farming from any further consideration.

I think that would be unfortunate because the ocean is about the only place left on Earth where truly large-scale biomass production could conceivably be carried out on a noncompetitive basis with man's other needs for space.

I would like to expand on that, if I might, with just a couple of other points relative to some of the earlier discussion today. I do feel that field experiments are obviously going to be needed in the development of this kind of a technology.

You can't understand what the problems are going to be until you try it, get your feet wet and make the effort, and these kinds of experiments inevitably are rather large scale and rather expensive. And I think they must be done.

But I would like to see them done first within some kind of a context of a broad general program studying the potential of marine biomass. This is something that I find lacking. There never has been a defined, broad-based program to look at all of the various potentials.

The Sargassum that I mentioned. The possibility of the weeds up in the New England area. A friend of mine at the University of Maine tried very hard to get a grant to look at the potential of seaweeds in the large estuaries along the Maine coast just to try to assess the biomass that is present there and was unable to get support to do this.

I think there are lots of approaches to this that ought to be looked at simultaneously and I don't see anybody worrying about the comprehensive problem as a whole. It seems the program in the Department of Energy for looking at marine biomass, such as it is, seems to have just grown up more or less adventitiously.

I certainly found out about it by accident. Many other people didn't know of its existence. I think that there should be some effort made to bring together specialists in this field to try to develop a comprehensive plan.

And the other concern I have is that large-scale studies should be recognized as being exploratory at this stage in the sense that this whole technology is new and we really don't know what the best species are or the best method of drawing them.

Although these experiments won't necessarily be large, they should not be viewed at the moment as a pilot project demonstrating some tried and true concept because I am afraid if this is the motivation, very quickly people would become disillusioned with the mistakes that will inevitably occur as a result of these early studies.

Thank you.

Mr. STUDDS. Thank you very much, Dr. Ryther.

Even with my layman's lack of knowledge, expertise, and sophistication in these matters, I am, nonetheless, always upset when I hear the Department of Energy on this or any other subject. Now you have made me worry even more than I normally do.

You started out by summarily dismissing the potential of terrestial biomass production as opposed to aquatic biomass, and I don't know if you have seen the figure 1 which accompanies the testimony of the Department of Energy earlier today of that minute portion of their budget which goes to this kind of biomass production at all.

Six percent goes to aquatic biomass and 9 percent, 50 percent more, to terrestial biomass which, I gather, you think has very little hope compared to aquatic.

Dr. RYTHER. I think, in terms of large-scale contributions to our energy budget that probably terrestial systems are much more limited than the marine. I think, in the short term the terrestial is going to be able to produce a much—make a much bigger contribution than the aquatic.

In the long run, I think, we have got to look at the ocean where we have the space to do this.

Mr. STUDDS. Did I understand you to say that you and others of your colleagues who are experts in the field were unaware, at least until recently, that the Department of Energy was even interested in the subject?

Dr. RYTHER. I found out about it, as I said, by accident. I was talking with a person I know in Louisiana State who was growing duck weed and found out somehow by accident. To my knowledge, there has been no advertisement of this, of the fact that they would entertain proposals or that there was such a program.

Mr. STUDDS. You were not overwhelmed by the announcement this morning that we have six full-time professionals working in the field in the Department of Energy?

Dr. RYTHER. No.

Mr. STUDDS. Were you aware of the Gas Research Institute project which was described earlier today?

Dr. RYTHER. Yes, I was and have been for a number of years. I have been following it with a great deal of interest and I have known Dr. Wheeler North for many years and Dr. Neushul.

Mr. STUDDS. So what you are saying to us, if I understand you correctly, is that our most experienced folks in this field have neither been gathered nor even had their views solicited by the Department of Energy at this point.

Dr. RYTHER. I have found some lack in bringing together a group of peers to either evaluate ongoing programs or to suggest new ones.

Mr. STUDDS. I don't have the heart to suggest you stop by the Department of Energy, even if you could find it, before you go back to Woods Hole.

Dr. RYTHER. I have mixed feelings about the fact that the gentlemen are no longer here. I am probably cutting my own throat in saying that other people ought to be solicited to share this pie but, nevertheless, I do feel that this is a lack.

Mr. STUDDS. I appreciate that.

Mr. Emery?

Mr. EMERY. Thank you very much, Mr. Chairman.

I guess I can only observe that this is further proof that we can't turn to the Department of Energy for a solution to all of our energy problems. Indeed, it is a little disconcerting to find the Department of Energy has not been aware of some work that has been going on for time.

I wonder if you have had an opportunity to examine the results of some of these biomass funding projects that Mr. Adams listed for us this morning. I know that you have been a recipient of some of these grants. Have you had a chance to observe the work generally,

even outside of your own, and, if so, can you give us an idea of the quality of the work that has been done, whether or not you think that the funding that has gone into biomass research has been well placed. What changes would you recommend to the program. What should we do to improve the response in this area?

Dr. RYTHER. I have been asked to review a number of proposals and progress reports in my own area of specialization and I think that my opinion has carried some weight with the individuals, so I certainly have no complaints in that respect.

I do feel, as I mentioned before, that a peer review system that is comparable to that used in some of the other agencies might be improved upon. There is some of that done but I don't think enough in the Department of Energy.

Mr. EMERY. Do you think it would be a valuable thing for a group of scientists, or biologists, or energy experts to regularly review these projects, hopefully, before they are undertaken so that we might have a better way of knowing?

Dr. RYTHER. Very much so.

Mr. EMERY. I think that is an excellent suggestion and one that we might consider. If we have been spending this tremendous amount of money and the Department of Energy experts can't even tell us what has been accomplished, it is appalling.

I asked a series of questions earlier this morning, and was quite alarmed by the fact that even some of the more fundamental aspects of the subject brought blank stares. Many times the administrator responsible for answering the questions is not the man who does the work. If the program is not being usefully used and if we can't see any tangible results coming from it, I think we had better start asking some questions to determine why.

I have no further questions. I do want to compliment you on your work and I hope we will see you here in the near future with further information and more encouragement.

Mr. STUDDS. It may be, Mr. Emery, that our witnesses come from too high a level in the bureaucracy. I think we ought to move away from the situation where we tend to get people in positions of far too great responsibility to have to know anything of substance. It may be that we ought to go down to the working level.

Mr. Hughes?

Mr. HUGHES. Thank you, Mr. Chairman.

I wonder if you could tell us, Doctor, if the seaweed that you have been successfully experimenting with can be cultivated in other areas, like, for instance, the Northeast?

Dr. RYTHER. The seaweed that we ended up working with is semitropical. It occurs throughout the world in the tropical belt and it gets up into the Northeast in the summertime as an annual summer plant. But, generally, speaking, it is more of a warm water species.

Mr. HUGHES. So it doesn't appear as if it would be too very successful, for instance, in this particular environment of the Northeast or off the California coast?

Dr. RYTHER. No, I don't think so. We did grow it up there in the summertime and some other species like it and they do very well during the summer period. I don't think anything grows particularly well in the Northeast in the winter. There just isn't enough

light. Chondrus doesn't grow, the Irish moss. It grows 6 or 8 months a year and then it just sort of shuts down. Those are the times of the year when these other ones can be grown too.

I think biomass production in the ocean has got to be done in the warm water areas where you can get year-round growth.

Mr. HUGHES. I take it that you have pretty much simulated the environment?

Dr. RYTHER. Yes, we are trying to as well as possible. We are growing these outdoors in ponds, big tanks, and that sort of thing.

Mr. HUGHES. Thank you, Mr. Chairman.

Mr. STUDDS. Thank you very much.

If you have time on the way to the airport I would appreciate your stopping by the Department of the Interior to give them a brief lecture on Georges Bank and the marine life out there.

Dr. RYTHER. Yes, that is a matter of very great concern to many of us.

Mr. STUDDS. Thank you. Have a safe trip home.

Our next witness is Dr. Michael Neushul. I hope I am pronouncing that correctly. President of Neushul Mariculture, Inc. Did I mispronounce you, sir?

Dr. NEUSHUL. That is correct, amazingly so.

Mr. STUDDS. Welcome.

**STATEMENT OF MICHAEL NEUSHUL, PROFESSOR OF MARINE BOTANY, UNIVERSITY OF CALIFORNIA, SANTA BARBARA AND, PRESIDENT, NEUSHUL MARICULTURE, INC., GOLETA, CALIF.**

Dr. NEUSHUL. Mr. Chairman and members of the committee, it is a privilege to be here to present my views as to the feasibility of oceanic macroalgal farms, and their potential yields, and the future potential.

As a member of the Bioenergy Advisory Panel for the Office of Technology Assessment, I can also comment briefly, but perhaps not as effectively as John has, on how oceanic biomass might fit into an overall scheme for meeting U.S. energy needs.

Since 1963, I have worked as a faculty member on the faculty of the University of California at Santa Barbara on various aspects of macroalgal biology, with research support from the biological oceanography program of the National Science Foundation and, more recently, with National Science Foundation support through the small business program of the Applied Science and Research Applications Division. This has made it possible to install an operational marine macroalgal farm in Goleta Bay, Calif.

In considering the potential of macroalgal farms, I think it is very important first to review what has and is happening in Japan and China where very large marine farms now exist.

As of 1970, there were 130,000 acres of sea surface under cultivation in Japan and, as of about 1976, there were 25,000 acres being cultivated along the coast of mainland China. Plans were being made to double this production.

I might add at this point that the primary architect of the Chinese program—Dr. C. K. Tseng—graduated from the University of Michigan and returned to China, and as I will indicate on the graph on the next page, is largely responsible for their program.

Chinese, Japanese, and Korean farms are primarily designed for food production and for the production of plants that yield chemicals used as emulsifying and gelling agents.

The graph provided here shows Japanese and Chinese advances in macroalgal mariculture and provides some approximate answers to questions that were raised earlier about what sort of time frame, and about types of breakthroughs needed for the development of large scale marine farms.

You will see that on this graph "J" stands for Japan and "C" stands for China. The Japanese marine farming efforts began back in the 1700's and continued up until about 1950 as a "traditional" process. In other words, they would plant and harvest according to seasonal events such as winds and so on, without a scientific basis for doing so.

The life history of the major organism (porphyra) they were farming was not known and so it was like a very primitive sort of a thing. As of 1950, the Japanese followed up on a discovery by an English woman that the life history of this alga could be controlled and their production increased considerably. Just prior to 1960, the Japanese began to use nets in the sea and to artificially seed their plants on them. At point "J3", they found that they could take seeded nets and freeze them and store them and then later plant them out in the sea. You can see that this resulted in a dramatic production increase. Because of coastal pollution in Japan they began to move their farms offshore and production again shot up very dramatically. What you are seeing here is a very interesting thing.

The history of agriculture, of course, is shrouded in the mists prehistory having its beginning some 10,000 years ago. What you are looking at here is the beginning of mariculture in Japan and China, where relatively few scientific advances account for most of this major upswing.

The production in China now is 150,000 dry tons per year.

The Chinese and Japanese do not have the large float-bearing kelps like Macrocystis, though we have been approached by representatives from those countries, and from Korea, and asked for seed stock for Californian kelp. I am quite sure that ultimately they will start growing these larger plants.

Macrocystis is, of course, the largest known marine plant, reaching lengths of up to about 140 feet. These produce, as you know, forest like communities where individual plants grow at rates of 3 percent per day. These growth rates are whole plant wet weights and are, as John Ryther indicated, really very spectacular things to watch.

The growth rate times the standing crop, of course, gives you the production. The standing crop in wild populations varies, but some actual numbers are of interest. Measured standing crop values range in natural beds from 2 to 97 wet tons per acre. The actual harvest total in California is about 160,000 wet tons per year, this being harvested by mechanical harvesters. With reference to an earlier question about mechanized harvesting, these harvesters were designed in about the 1930's and haven't changed very much since that time. So, while harvesting is certainly mechanized on a

large scale there certainly seems to be considerable room for improvement, at least in my opinion.

To give you the harvest from an actual kelp bed of about a square mile or so in area at Goleta, this ranged from about 12 wet tons per acre per year in 1975 to 7.5 wet tons acre per year in 1977. Due to the inefficiency of the harvester and the fact that only the tops of the plants are taken only about 10 percent of the material present is harvested. I would guess that in a farm situation, where one were growing these large plants one would design a method that would allow you to harvest much more than 10 percent of the biomass produced.

The potential yields from oceanic farms, is the subject of speculation. I think we could assume that if we were farming macroalgae, as the Chinese are doing, we would be able to minimize damage and loss due to wave action, sloughing, and other factors that influence natural kelp beds at the present time.

It is important to remember that in estimating production per acre the acre in this case is not a land acre and it is not an acre that you have to buy, so that the cost per unit area is considerably less than it would be on land. A major cost would be for nutrients.

This major point has been raised here by Mr. Hughes. I think the potential yield of future ocean farms will be primarily based on how efficiently nutrients can be supplied to these plants and how efficiently they can be recycled in the large populations that might be farmed.

As of now, we have the deep ocean "nutrient irrigation" approach, being studied by the G.R.I. group. We are presently using fertilizers on our Goleta Bay farm. The Chinese and Japanese both have experimented with various methods of applying fertilizer from containers in the sea, sprayed on the sea surface from ships, and so on.

So it doesn't seem to be the question of whether fertilization will work but how to apply it most effectively that seems to be the most important point. Dr. Ryther brought up the point that the Sargasso Sea should be considered, which is very important since here you are talking about a huge area of sea surface where much of the nitrogen in the plants comes from nitrogen fixing blue-green algae which grow on the surfaces of the sargassum plants. So that this is yet another approach that might be used to supply nutrients to the plants in an open ocean farm.

In conclusion, it is important to note that floating macroalgae occur in natural kelp forests, in the Sargasso Sea over substantial areas of the sea surface, and in Japan and China, man-made farms that are thousands of acres in extent.

Thus it seems that scientific macroalgal cultivation, although it is still very new, has progressed substantially in the last two decades. This progress has been made by a relatively few people who are still alive, and kicking. You can talk to them and find out how they did it in Japan and China. Apparently the task was not as difficult as one might expect.

So I think it is unduly pessimistic to contend that the development of marine farms has to be a tremendously long-term project. Since 20 years in Japan and China has seen considerable progress,

I would assume that we in the United States could achieve at least as much, in the future. Thank you.

[The following was received for the record:]

STATEMENT OF MICHAEL NEUSHUL, PROFESSOR OF MARINE BOTANY AT THE UNIVERSITY OF CALIFORNIA, SANTA BARBARA, AND PRESIDENT, NEUSHUL MARICULTURE INC., GOLETA, CALIF.

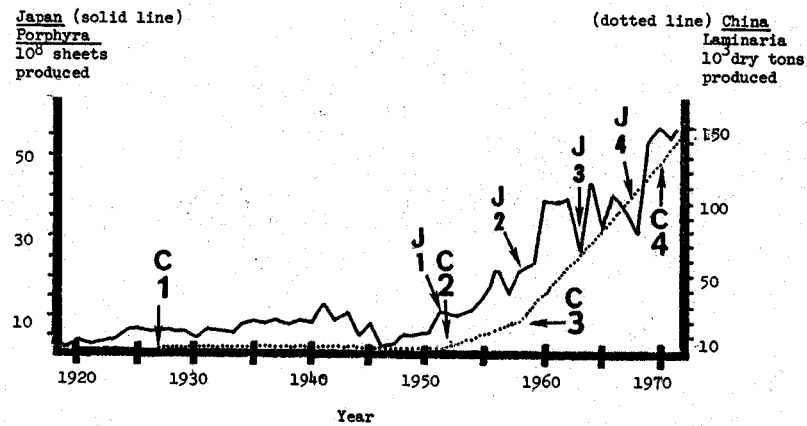
Mr. Chairman and Members of the Subcommittee, it is a privilege to be here to present my views as to the feasibility of oceanic macro-algal farms, their potential yields, and the future potential of such farms for the production of food and energy in an environmentally acceptable manner. As a member of the Bioenergy Advisory Panel of the Office of Technology Assessment, I can also comment on how oceanic biomass production might fit into an overall scheme for meeting present and future U.S. energy needs.

Since 1963, I have worked at the University of California at Santa Barbara, on various aspects of macro-algal biology, with research support from the Biological Oceanography Program of the National Science Foundation and the Sea Grant Program. The NSF small-business research program has recently made it possible for me to install a near-shore macro-algal farm, designed to produce plants that yield industrial and pharmaceutical chemicals (agar, algin, carageenan). This applied research is sponsored by the Applied Science and Research Applications division of the National Science Foundation.

In considering the potential of marine macro-algal farms, for the production of chemicals, food and energy, I feel that it is very important to first consider what is now happening in Japan and China, where large marine farms now exist. Since the giant, float-bearing kelps do not occur and have not yet been introduced into Chinese or Japanese waters, it is important to review U.S. harvests from the as-yet uncultivated kelp beds of California.

As of 1970, there were some 130,000 acres of sea surface under cultivation in Japan. In 1976 there were some 25,000 acres being cultivated along the coast of mainland China and plans were being made to double this. Additional sea surface is farmed in Korea and the Philippines. These farms are all designed to produce macro-algae that are eaten directly as a food, or that provide a source of chemicals used as emulsifying and gelling agents.

Japanese (J) and Chinese (C) advances in macro-algal mariculture




A graphic summary of the historical development and farm yields in China and Japan, illustrates the rapid progress made in the last few decades. In China, the kelp, *Laminaria japonica,* was introduced from Japan in 1927. (C 1). In 1952 the

Chinese began to cultivate these plants on rafts (C 2). In 1957 new genetic strains were selected that made it possible to greatly extend the range of cultivation (C 3). Algal culture facilities were developed to produce seedstock. Continued selection and improvements in culture techniques, in particular the development of methods for applying fertilizer, has led to increased yields. High-iodine yielding strains were developed in 1970 (C 4). Present production of *Laminaria* in China is in excess of 150,000 dry metric tons per year.

In Japan, the traditional cultivation of *Porphyra* on sticks placed in shallow water, started in the 1700s, and continued to about 1950 (J 1) when net culture was introduced. In 1957 the application of recently discovered life-history phases (previously unknown) made it possible to artificially seed this plant for the first time, (J 2) and a rapid increase in production followed. In 1963, it was found that seeded nets could be frozen for long-term storage, and that this procedure also enhanced crop production (J 3). Problems of pollution in coastal waters made it necessary to move what had traditionally been near-shore farms, out into the open sea. This (J 4) also produced a substantial increase in the production of *Porphyra.*

*The harvesting of the giant kelp, Macrocystis in California*

The giant kelp, *Macrocystis,* is the largest known marine plant, reaching lengths of up to 140 feet. These plants produce forest-like communities, where individual plants grow at rates of 3 percent per day, under optimum conditions. Measurements of the standing crop in natural kelp beds range from 2 to 97 wet tons per acre. An annual harvest of some 160,000 wet tons is collected by mechanized harvesters in California. Unfortunately this is not adequate to meet the present demand and additional kelp is imported from Argentina, South Africa and elsewhere.

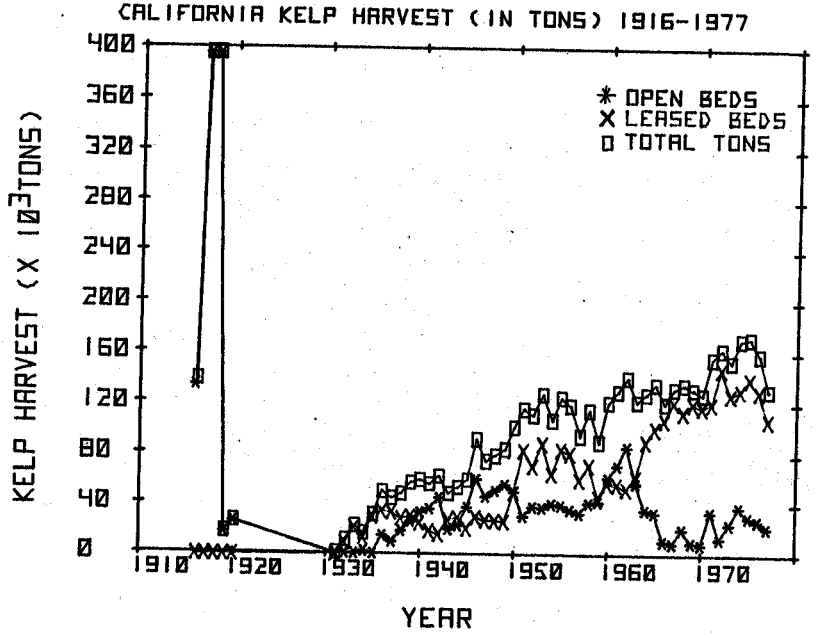
Examples of harvests from a single bed of about 680 acres in area (bed number 26, in Goleta Bay) range from 12 wet tons per acre in 1975 to 7.5 wet tons per acre in 1977. The amount of kelp harvested is only a small amount of the total produced. From measurements of beach drift in Goleta Bay, we estimate that at least 9 tons per acre per year are cast ashore. Additional kelp sloughs away, and is eaten, degraded or dissolved. The standing crop in this kelp bed is between 30 and 40 wet tons per acre, the plants being separated from one another.

*The potential yield of oceanic kelp farms, where Macrocystis or other float-bearing kelps would be grown*

It is logical to assume that a farmed population of macro-algae would be planted and managed in such a way as to minimize damage due to wave action, plant loss due to sloughing, and other adverse effects, like those seen in natural kelp forests. Also, as in the Chinese farming effort, genetic selection for improved yield is likely to increase the production over that seen in natural kelp forests.

In making assumptions about yield, disputes commonly arise as to the amount that can be produced per acre. It is important to remember here that in contrast with land-based energy farming, a major cost factor (the cost of the land) is not involved. Thus it does not really matter whether the yields are high or low, as long as the unit costs for farming (both in terms of money and energy) are minimized.

The most important factor, influencing the yield of natural kelp forests, is the availability of nutrients. It is logical to assume that this would also be the case for farmed areas of the sea, particularly the open sea where nutrient levels are low. Thus, in my opinion, the potential future yield of oceanic kelp farms will depend on how efficiently nutrients can be supplied to the plants, and whether or not these nutrients can be recycled to the farm once methane is extracted from the harvested crop.




The General Electric, Cal-Tech, Institute of Gas Technology farm is one example of what might be called "nutrient irrigation." It appears from preliminary data that the application of upwelled water (which is nutrient rich) to young kelp plants, will increase their growth rates by a factor of four (Gerard, personal communication). We have used commercial fertilizer to produce increases in yield, also in preliminary experiments. The Chinese and Japanese have also applied fertilizers to macro-algal crop plants. Thus it seems that the question is not whether or not nutrient irrigation will work, but how to make it work most effectively.

In making estimates about large scale open ocean farms, it is useful to consider the large area of sea surface now occupied by the Sargasso sea. Here floating brown algae occur over some 2 million square miles of sea surface. The fixation of nitrogen by blue-green algal epiphytes on the plants, provides a major portion of the needed nutrients (at least nitrogen). There is a natural recycling of other nutrients in the floating plant clumps. One might say that while the productivity in the Sargasso sea is low, so is the cost (which is zero).

In conclusion, it can be seen that floating macro-algae occur both naturally in kelp forests and in the Sargasso Sea over substantial areas of the sea surface. Man-made farms in Japan and China occupy significant areas of sea surface as well. Scientifically-based macro-algal mariculture has existed for less than thirty years, mostly in the orient where substantial progress has been made. In my opinion it is unduely pessimistic to contend that the scientific establishment in the United States cannot design, test and operate effective open ocean, macro-algal farms for the future production of food and energy. One need only look at the tremendous productivity of U.S. agriculture, as an example of what can be achieved in a short period of time. U.S. mariculture is just beginning. The potential of a renewable food and energy source from mariculture is such that it should certainly be given a chance.

Mr. STUDDS. Thank you very much, Dr. Neushul.

Has it occurred, to your knowledge, to anyone at the Department of Energy to go talk to some of these folks in China and Japan while they are still, as you put it, alive and kicking?

Dr. NEUSHUL. We had an international seaweed symposium at Santa Barbara a couple of years ago where we had invited experts from all around the world. We had about 900 attendees and there was a Department of Energy representative who did attend those meetings and, as far as I know, did listen to some of the presentations.

Mr. STUDDS. You say they have been doing this in Japan since the 18th century?

Dr. NEUSHUL. That is correct.

Mr. STUDDS. That is probably considered primitive in the Department of Energy. I assume that the sole purpose or the principal purpose of the Japanese and Chinese production is for food?

Dr. NEUSHUL. Yes, that is correct, although they are interested in biomass energy production and did form a study group which came and visited this country, I believe, last year or the year before.

Mr. STUDDS. You introduced them to the giant kelp, did you?

Dr. NEUSHUL. No, I didn't talk to them.

Mr. STUDDS. I assume that was a large part of their purpose, from what you said.

Dr. NEUSHUL. I guess so. I know this happened but I didn't meet any of the representatives of that study group.

Mr. STUDDS. The California harvest you say is 160,000 wet tons. What is that used for primarily?

Dr. NEUSHUL. The principal product of this is for alginates, which are used as emulsifying agents in all sorts of things ranging from cosmetics to beer to paints and pharmaceutical products, and so on.

Mr. STUDDS. The same product that comes from our Irish moss.

Dr. NEUSHUL. Yes, very similar.

Mr. STUDDS. And we don't even satisfy the domestic demand for that.

Dr. NEUSHUL. No, we don't. At the present time we are importing kelp from Argentina and South Africa and other places.

Mr. STUDDS. What accounts for the drop off, according to your graph, in the last few years of the California kelp production?

Dr. NEUSHUL. I am not really sure. It could be a climatalogical thing since these are wild populations. In the open beds, that is, the ones shown at the bottom of the graph, it could be from overharvesting.

But since the harvesting takes only about 10 percent of the total production it is pretty hard to say that overharvesting is damaging.

Mr. STUDDS. You heard Dr. Ryther testify before you at the end of his testimony. He injected something of a note of caution as to not go too fast. I detect a great deal more enthusiasm on your part than on his for ocean biomass in the near future.

Dr. NEUSHUL. I agree fully with what Dr. Ryther said. I think by caution he is talking about a broadly based program where a number of options are considered. I would be a little bit more enthusiastic and proceed perhaps a bit more rapidly.

Mr. STUDDS. Did you hear the testimony this morning from the Department of Energy?

Dr. NEUSHUL. Yes, I did.

Mr. STUDDS. What was your reaction to that in terms of the quality and quantity of their commitment in this field and the speed with which they seem to be going and the priority which they seem to attach to it?

Dr. NEUSHUL. I think they are being very conservative, but that may change in the future, hopefully.

Mr. STUDDS. There are a number of things that may change around here. Thank you.

Mr. Hughes?

Mr. HUGHES. Thank you.

Doctor, did I understand that you are yourself involved as a small businessman in the production of kelp?

Dr. NEUSHUL. Yes, that is correct.

Mr. HUGHES. What, in your judgment, is the smaller size operation a small businessman could have to have an operation that would be productive and successfully, economically viable?

Dr. NEUSHUL. We have—I don't know whether I should say this proudly or with shame but, we have the largest marine farm in the United States as far as I am aware, and that is 1 acre in extent.

Mr. HUGHES. Only 1 acre?

Dr. NEUSHUL. One acre. But this is still an experimental farm.

Mr. HUGHES. Where is it actually located?

Dr. NEUSHUL. It is located in Goleta Bay near Santa Barbara, Calif.

Mr. HUGHES. Have you had any difficulties with other uses; recreational, fishery, and other uses?

Dr. NEUSHUL. No, we haven't.

Mr. HUGHES. Have you found it is compatible with the other uses of the bay?

Dr. NEUSHUL. As far as we are able to tell, it is barely visible from the coast. It is a few buoys showing on the sea surface. The area of ocean used is leased from the State of California.

Mr. HUGHES. Can you describe your operation for us a little bit?

Dr. NEUSHUL. Yes. We use pipe as the farm substrate. We have anchors which anchor buoys and pipes into position in the bay and on the pipes we attach the seed stock. We produce the seed stock at the university in greenhouses and from culture dish material. This is raised up to a certain size and vegetatively propagated and placed on the farm.

The preliminary growth rates of plants that we have been getting have been 1 to 2 percent wet weight increase per day. As I mentioned earlier, the farm project is supported by the National Science Foundation applied research program for the development of chemicals from alternative sources, and it is primarily designed at the moment to produce agar.

Mr. HUGHES. How do you actually harvest the kelp?

Dr. NEUSHUL. Right now this is an experimental farm so we are just harvesting by hand. Ultimately, if it gets larger than an acre, we would have some sort of harvesting machinery doing it.

Mr. HUGHES. From your testimony I gather there really isn't any difficulty in marketing the kelp because we are presently importing kelp from other countries.

Dr. NEUSHUL. That is correct.

Mr. HUGHES. Mostly from South Africa?

Dr. NEUSHUL. And Argentina.
Mr. HUGHES. Thank you.
Thank you, Mr. Chairman.
Mr. STUDDS. Thank you, Dr. Neushul.
Our next and final witness is Dr. Bud Brinkhuis, assistant research professor at the Marine Sciences Research Center, the State University of New York at Stony Brook, who is presenting testimony on behalf of Dr. Don Squires, director of the New York Sea Grant Institute, the State University and at Cornell.

**STATEMENT OF BOUDEWIJN BRINKHUIS, RESEARCH PROFESSOR, MARINE SCIENCES RESEARCH CENTER, STATE UNIVERSITY OF NEW YORK, STONY BROOK, ON BEHALF OF DON SQUIRES, DIRECTOR, NEW YORK SEA GRANT INSTITUTE, STATE UNIVERSITY OF NEW YORK AND CORNELL UNIVERSITY**

Dr. BRINKHUIS. What I would like to do is read into the record Dr. Squires' testimony. He regrets that he can't be here today because he has an annual site visit as part of the National Sea Grant College program staff that he must attend yesterday and today.

I have been active in the field of oceanography for the last 30 years, with the last two decades as an active researcher and the past 10 years as director of New York's Sea Grant College program.

That program, a joint activity of the State University of New York and Cornell University, has been a consequential factor in the revitalization of New York's coastal region and in increasing awareness of its economic potential.

Conversion of marine biomass through methanogenesis offers a very exciting opportunity for New York and its metropolitan region. Development of this energy source would further diversify the coastal productivity of the State and would be compatible with other uses of our coastal zone.

We are pleased to be a part of a budding program and intend to be active participants in its conduct. In my comments, I speak for myself, and not for the State University or Cornell.

In other presentations at this hearing you will have heard of the substantial progress being made on the west coast in the farming of macrocystis or giant kelp as a feedstock for methanogenesis.

This past summer a series of meetings between the Gas Research Institute, General Electric Corp., the New York State Energy Research and Development Authority, NYSEARCH, which is a public utility-financed research arm of the gas companies, and Brooklyn Union Gas resulted in a determination for New York State to move ahead in marine biomass research.

There is unanimity among all parties that marine biomass production must be explored fully and without delay. The Sea Grant Institute was asked to participate in these meetings as a representative of the academic research community. Together with the General Electric Corp., we have developed a research plan toward the goal of test farming of marine biomass in New York State.

Preliminary investigations under this plan were initiated in June of this year, at a low level of funding. Final answers to some

of the research questions await further funding and completion of the studies already initiated.

But, in commencing we have taken an important step. The remainder of my comments will, of necessity, be speculative since data to be otherwise are lacking. Let me sketch out the differences between marine biomass production on the east coast and on the west coast and then examine some of the alternatives that may present themselves in the next several years.

There are significant differences between the oceanographic characteristics of the east and west coasts:

First of all, the east coast is bounded by a broad, gently sloping continental shelf over 100 miles in width, and the water is less than 300 feet deep. Water depths comparable to those off California where biomass farming is being conducted, and where the continental shelf is very narrow, only occur far from shore in the East.

Second, nutrients, which are a limiting factor in the productivity of marine biomass farming on the west coast, occur in abundance in New York's coastal waters. Nitrogen values similar to those artificially induced in the west coast operation are found naturally in most shelf waters of New York. Nitrogen, furthermore, in New York's waters is primarily nitrate and ammonia. Thus, the high-technology nutrient pump required for the west coast farm would be unnecessary in a New York operation.

Third, the light penetration in the east coast waters is more restricted than along most areas of the west coast. The depth to which photosynthetic action can occur in New York waters may well be the most significant factor in designing test farms. Although light penetration in the coastal waters of New York is limited in part by suspended sediment carried from land, most of the turbidity is due to phytoplankton growth stimulated by nutrient enrichment from human activity.

The fourth factor, the North Atlantic has a well-deserved reputation for tempestuousness. It may prove to be a hostile environment for marine biomass farming more so than the placid eastern Pacific. This will pose interesting challenges for the ocean engineers in designing test farms.

The results of these basic differences is that east coast biomass production may involve techniques somewhat different from those used on the west coast. This will not inhibit development of the program; rather, the west coast experience will provide important baselines from which other environments can be compared and evaluated. Much of the basic information generated by the west coast test farm will be used in adapting biomass operations to other oceanographic and sociopolitical regimes.

One important area requiring immediate research is the selection of suitable feedstock species on the east coast. Macrocystis has been intensively studied on the west coast and its characteristics have been found suitable for biomass production for conversion to methane.

Recognizing that one species may not be optimal in all coastal oceanographic environments, the master plan developed by the Gas Research Institute calls for such research. Macrocystis does not occur naturally along the east coast. Its absence is probably attributable to a lack of sufficient rocky substrate for attachment of

holdfasts and, where such substrate does exist, to the highly turbid nature of most coastal waters along the east coast.

Further, the normally higher temperatures we find in the inshore waters during the summer months along the New York coastline could well inhibit the growth and reproduction of macrocystis.

Thus, there are several important questions concerning selection of optimal feedstock organisms on the east coast. First, what production of biomass can be anticipated from native seaweeds? Two, how does their production compare with that of macrocystis on the west coast and is the quality of the material appropriate for efficient production of methane?

Three, given the above information, should the introduction of macrocystis to the east coast be considered? This is an important question because it considers not only the relationship of macrocystis to energy production, but also the fundamental issue of the introduction of an exotic plant species to the inshore coastal ecosystem of the east coast.

Could macrocystis be controlled if it is introduced? What, if any, hazards would its introduction pose? How would its productivity on the east coast compare with its productivity on the west coast? Will macrocystis withstand the seasonal temperature, nutrient, and turbidity regimes of the east coast?

These are the questions that need to be answered to select the appropriate feedstock organisms for the east coast biomass farming.

As I mentioned, the sea grant Institute has initiated preliminary work in this area. This experimental work is being performed by faculty and staff of the Marine Sciences Research Center at the State University of New York's Stony Brook campus.

Marine Sciences Research Center offers the most complete research capability within the State in the fields of biological, physical, chemical, and geological oceanography. As the program moves toward the development of small-scale test farms, engineering guidance on the design of the test and prototype farms may be provided by faculty from the Schools of Engineering at the State University at Buffalo and Cornell who have been doing related research under sea grant auspices.

The staff of the Long Island Regional Planning Board who have been deeply involved in aquaculture studies have agreed to address some of the social and legal problems and opportunities stemming from the introduction of this type of facility into the coastal waters of the State.

What are the potentials for the east coast? It seems reasonable to assume that preliminary screening of a number of indigenous species can be accomplished within a year. The future direction of the programs in New York will depend heavily on the results of that screening process. While no clear pathway presents itself, there are a number of interesting alternatives.

Alternative No. 1 we envision being a low technology alternative. This alternative might result if some of the floating seaweeds such as Sargassum or Fucus—the latter is also known as rockweed—were to prove sufficiently productive to be of economic significance. If these species would vegetatively reproduce and could be cultured

as floating plants, the farm configurations involving extensive surface areas in which the plants were separated in shallow pens might be visualized.

This farming mode would require only floating pens and perhaps nets to confine the seaweeds. The size of economically significant units would depend on factors of productivity and price, but it is possible that these would scale to fairly small holdings.

If so, there is the possibility that waters within the State jurisdiction could be used and that private holdings, through leases of bottom lands, et cetera, would result. These, operating in the private sector, could complement larger offshore holdings which would be operated by the public utilities.

Plants would be propagated and placed in pens for grow-out until they reached optimal harvesting size. In a monoculture system, if winter productivity were insufficient to warrant cropping, the mature plants could be held in pens until growth resumed in the spring.

Alternatively, it may be possible to develop a polyculture system, including some seaweed species that grow quite well in the winter. This would permit year-round production. Harvesting would involve surface skimming of the floating plants and their transport by barge to shoreside digesters.

Second level of technology alternatives we would consider a medium level. This option envisions an intermediate between the low-technology alternative and the macrocystis-like farm operating on the west coast. It assumes that a long-stipe attached seaweed—for example, laminaria—is found to be the most promising feedstock. This plant, not of the giant kelp dimensions but still requiring anchoring of the holdfast in the fashion of macrocystis technology, would probably be grown in farms farther offshore than the low-technology alternative.

This type of farm is complicated by having to maintain some type of underwater anchoring surface to which the plants might be attached. Such a more complicated structure is, of course, more expensive to construct and maintain. This structure, therefore, is seen as more capital intensive than the low-key technology system.

The third, which we call high technology alternative, is as follows: This option implies more sophisticated technological systems than the above and approaches the requirements of the west coast macrocystis farm. Should macrocystis prove to have productivity characteristics significantly superior to the native seaweeds and it is decided to attempt introduction of this species to the east coast, a number of alternatives might present themselves.

Should a shorter, perhaps juvenile, plant perform adequately, a shallower water farm might be preferable. If full-sized—that is, 15 meters or more in length—plants are required, farm sites necessarily may have to be further offshore than for alternatives 1 and 2, a factor that affects both the capital construction costs and the transportation costs of the feedstock to shoreside digesters.

Since, however, all alternatives involve transportation of wet bulk biomass by barge, this latter becomes a marginal increase to cost. Capital construction costs increase significantly as one moves farther into the open waters of the North Atlantic. To develop farms on the margin of the Continental Shelf will require substan-

tial engineering achievements, many of which have been addressed in the west coast test farm operation.

In addressing these alternatives, I have not touched upon the many problems associated with the conversion of biomass to methane—natural gas. This is an area of research to be carried out by our colleagues at General Electric and presents problems of some magnitude—but of the same genre regardless of the feedstock species.

The problem here, as I understand it, is to produce a synthetic natural gas that is economically feasible. Biomass conversion, of course, has the long-term benefit of being based upon a self-renewing natural resource. Screening of candidate species is a necessary first step in the development of this new energy source in New York State.

I believe that we have an exciting opportunity to develop marine seaweeds for bioconversion to synthetic natural gas. New York's coastal waters are enriched with essential micronutrients necessary for natural production at high levels. Selection of a species with appropriate productivity which also proves to have a chemical composition amenable to efficient microbiological conversion to methane awaits experimentation and investigation. From this research an array of opportunities opens up—opportunities that I believe the State of New York and its public utilities anticipate using to the fullest.

Mr. STUDDS. Thank you very much.

Are you by any chance using, at least in part, a euphemism when you say New York's coastal waters are enriched with essential micronutrients necessary for natural production at high levels? Is that, at least in part, a reflection of the phenomenon which in another part of this committee's jurisdiction is viewed as a problem rather than as an opportunity?

Dr. BRINKHUIS. Yes, that is true. The high nutrient values we find in New York's coastal waters are primarily the result of sewage effluent.

Mr. STUDDS. So you are looking on the bright side of that problem.

Dr. BRINKHUIS. This is possibly an alternative for absorbing those nutrients. You can look at that side too.

Mr. STUDDS. What is the nature of the research plan between New York Sea Grant and General Electric?

Dr. BRINKHUIS. As I understand it, the research plan is in various phases over the next 3 or 4 years. The first year project, which is supposed to get underway, I believe, this month—or, if not, October—is to start selecting a number of species of seaweeds that could be screened both for chemical composition to find out how compatible it is already with what is known about macrocystis, and to take a limited number of these species and run them through a methanogenesis operation, in other words, anaerobic digestion.

Mr. STUDDS. So there hasn't been any testing as yet——

Dr. BRINKHUIS. No, this is a research program that was just initiated this summer. In fact, we wrote up a proposal to conduct the research only this summer.

Mr. STUDDS. How far away are we actually from your first test farms?

Dr. BRINKHUIS. I believe the schedule calls for a small-scale test farm on the order of about a quarter acre in size in about 1982.

Mr. STUDDS. Will that be in the New York Bight area? Where will that be?

Dr. BRINKHUIS. We have as part of this research program, we are supposed to try to determine what environmental characteristics might lend itself to maximum seaweed growth, including nutrient levels, temperature, currents, and we propose to explore the New York Bight area, Long Island Sound as well as some of the shallow coastal embayments along Long Island's coast.

We don't know at this point but we are going to explore at least three or four different areas.

Mr. STUDDS. Is the Department of Energy involved in your undertakings at all, the Federal Department of Energy?

Dr. BRINKHUIS. I am not sure whether I really understand how they relate to this except that——

Mr. STUDDS. No one understands how they relate to anything, but I was just wondering if they were directly involved.

Dr. BRINKHUIS. I don't think they are directly involved, no.

Mr. STUDDS. Are they indirectly involved?

Dr. BRINKHUIS. Yes, by being related to the New York State Energy Research and Development Administration.

Mr. STUDDS. Which is at least partially federally funded?

Dr. BRINKHUIS. Right.

Mr. STUDDS. To your knowledge, have there been any attempts to date to actually transplant macrocystis off the east coast?

Dr. BRINKHUIS. No, not in the field anyway.

Mr. STUDDS. God knows what will happen when exposed to our rich micronutrients. We may all be enveloped.

Dr. BRINKHUIS. I have brought some back from the west coast and grown it in aquaria.

Mr. STUDDS. But not in New York Bight?

Dr. BRINKHUIS. Not in New York Bight, no. We are using the same nutrient levels in the tank.

Mr. STUDDS. Did it do remarkable things?

Dr. BRINKHUIS. They grow quite well, yes.

Mr. STUDDS. Does it grow faster than on the west coast?

Dr. BRINKHUIS. It was just a small number of plants. We only took back 20 plants, and they were small plants. They tripled in size in about 3 or 4 weeks. We are not that far along. We just started this research.

Mr. STUDDS. Perhaps you should clear with the Navy, the Coast Guard and a few others before you put that stuff in the New York Bight. There is absolutely no telling what may happen.

Thank you very much. We appreciate your testimony.

This concludes the third in our series of hearings on ocean energy and the subcommittee will stand adjourned.

[Whereupon, at 3:45 p.m. the subcommittee adjourned.]

# OCEAN POLLUTION PLANNING AUTHORIZATION AND OVERSIGHT

FRIDAY, FEBRUARY 29, 1980

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
*Washington, D.C.*

The subcommitte met, pursuant to notice, at 10:15 a.m., in room 1334, Longworth House Office Building, Hon. Gerry E. Studds (chairman of the subcommittee) presiding.

Present: Representatives Studds and AuCoin.

Mr. STUDDS. The subcommittee will come to order.

Today's hearing concerns the National Ocean Pollution Research and Development and Monitoring Planning Act.

Signed into law last Congress, this act has as its major purpose the coordination of ocean pollution research efforts currently performed by 11 different Federal agencies. The chief coordinating mechanism is to be a biennial 5-year plan, the first of which was published in late 1979.

The first plan contains a listing of how much money each Federal agency is spending on specific pollutants, sources of pollution, and their regional effects. As mandated by the law, the plan also categorizes as high, medium, or low priorities gaps or needs in current ocean pollution research and monitoring efforts.

Unfortunately, although the first plan does list these priorities, it fails to state which three or four issues should be addressed first and foremost—a difficult question, but one that must be addressed. I realize the difficulties interagency committees encounter while attempting to rank certain problems as more pressing than others, but I do not think the underlying purpose of this law will be fulfilled until we know where there are disparities between current efforts and current needs.

The most obvious question that needs answering is where do we go from here. Is there really a need for a new plan every 2 years, and will such plans make a difference in our struggle to minimize and eventually eradicate ocean pollution?

[The bill and an executive communication follow:]

96TH CONGRESS
2D SESSION

# H. R. 6615

To amend the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978 to authorize appropriations to carry out the provisions of such Act for fiscal year 1981.

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IN THE HOUSE OF REPRESENTATIVES

FEBRUARY 26, 1980

Mr. MURPHY of New York (for himself, Mr. MCCLOSKEY, Mr. FUQUA, Mr. STUDDS, Mr. PRITCHARD, Mr. AMBRO, Mr. WALKER, Mr. FORSYTHE, Mr. BROWN of California, and Mr. BLANCHARD) introduced the following bill; which was referred jointly to the Committees on Merchant Marine and Fisheries and Science and Technology

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# A BILL

To amend the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978 to authorize appropriations to carry out the provisions of such Act for fiscal year 1981.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That section 10 of the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978, as amended (33 U.S.C. 1709), is amended—

(1) by striking out "and" after "1979,", and

(2) by striking out "1980." and inserting in lieu thereof "1980, and not to exceed $3,000,000 for the fiscal year ending September 30, 1981.".

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EXECUTIVE COMMUNICATION No. 3581

THE SECRETARY OF COMMERCE
Washington, D.C. 20230

FEB 26 1980

3581

Dear Mr. Speaker:

Enclosed are six copies of a draft bill

"To amend Sections 4 and 10 of the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978, as amended, to extend the appropriations authorization to carry out the provisions of such Act for fiscal years 1981 and 1982, and for other purposes.",

together with a statement of purpose and need in support thereof.

We have been advised by the Office of Management and Budget that there would be no objection to the submission of this legislation to the Congress and further that its enactment would be in accord with the program of the President.

Sincerely,

Secretary of Commerce

Enclosures

Honorable Thomas P. O'Neill, Jr.
Speaker of the House of Representatives
Washington, D. C. 20515

A BILL

To amend Section 4 and 10 of the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978, as amended, to extend the appropriations authorization to carry out the provisions of such Act for fiscal years 1981 and 1982, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978, as amended (33 U.S.C. 1701, et seq.), is amended as follows:

(a) in subsection 4(a), by deleting "February 15" from the last clause of that subsection and inserting in lieu thereof "April 30;" and

(b) in Section 10, by inserting a semicolon in lieu of the comma after "1979" and by striking the period after "1980" and inserting in lieu thereof "; not to exceed $3,000,000 for the fiscal year ending September 30, 1981; and such sums as may be necessary for the fiscal year ending September 30, 1982.

69-848 O - 81 - 6

STATEMENT OF PURPOSE AND NEED

The National Ocean Pollution Research and Development and Monitoring Planning Act of 1978, as amended, authorizes the establishment of a comprehensive 5-year plan for ocean pollution research, development and monitoring which would coordinate all federal activities in these areas. This plan, completed in 1979, must be revised every two years. The National Oceanic and Atmospheric Administration (NOAA) is designated as the lead agency to prepare the above plan; to execute a program of ocean pollution research, development and monitoring in a manner consistent with the plan; and to ensure dissemination of information from federal ocean pollution research, development and monitoring programs. The authorization of appropriations for this Act expires September 30, 1980.

This bill will extend subsequent submission dates for the biennial revisions to the above plan from February 15 to April 30. Such an extension is necessary to assure adequate review of the plan by the Executive Branch on a schedule which promotes better coordination of the plan with the budget projections for relevant agencies. The bill also will extend the appropriations authorization for carrying out the Act through fiscal year 1982. Such an extension will allow NOAA to carry out its functions under the Act for two more years.

Mr. STUDDS. Our first, last and only witness this morning is Mr. James Walsh, Deputy Administrator of NOAA, and Chairman of the Interagency Committee on Ocean Pollution Research and Development and Monitoring.

Good morning.

**STATEMENT OF JAMES P. (BUD) WALSH, DEPUTY ADMINISTRATOR, NOAA, DEPARTMENT OF COMMERCE, AND CHAIRMAN OF THE INTERAGENCY COMMITTEE ON OCEAN POLLUTION RESEARCH AND DEVELOPMENT AND MONITORING, ACCOMPANIED BY DR. DAIL W. BROWN, ACTING DIRECTOR, NATIONAL MARINE POLLUTION PROGRAM OFFICE, NOAA; AND CAPT. LAWRENCE SWANSON, DIRECTOR, OFFICE OF MARINE POLLUTION ASSESSMENT, NOAA**

Mr. WALSH. Good morning, Mr. Chairman.

Mr. STUDDS. I will not ask you why San Francisco is on the front of your report.

Mr. WALSH. It was a very pretty picture, and actually I did not get much choice on it.

Mr. Chairman and members of the committee:

I welcome the opportunity to appear today in support of reauthorization of Public Law 95-273, the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978. You can see why we call the act Public Law 95-273.

With me today are two individuals who spend most of their time on pollution matters in NOAA. Dail Brown, who is on my left, is presently the Acting Director of our national office. His present responsibility is putting together the plan and overseeing its implementation.

On my right is Larry Swanson, who is currently in charge of marine pollution assessment within our Office of Research and Development. It is Larry's job to oversee our actual research projects, such things as the funding of the projects under this act as well as under other pollution research programs within the Office of R. & D. He has the added responsibility of coordinating throughout NOAA all our marine pollution programs. We have a very sizable set of programs.

The act mandated that a comprehensive 5-year plan for Federal ocean pollution research, development, and monitoring programs be developed in order to provide improved planning and coordination of such programs within the Federal Government. A further purpose is to develop and disseminate information about pollution and its impact on the development of ocean and coastal resources.

This undertaking has proved to be no small task. At present, 7 departments and 4 agencies are conducting or sponsoring nearly 1,000 discrete projects relating to ocean pollution research, development, and monitoring. Expenditures for these projects are projected to be $188 million in fiscal year 1980.

The first 5-year plan is complete and work is already well underway for revisions in 1981. We believe that the act has made a positive contribution to improve planning in this area, but much more needs to be done. Consequently, the administration supports reauthorization of the act for fiscal years 1981 and 1982. We have sent a bill to the Congress for that purpose.

I would now like to review for you our efforts to carry out the provisions of the legislation, and to outline our plans to improve the plan and our programs.

The act requires the preparation of a 5-year plan which includes a detailed inventory of existing Federal programs, an assessment and ordering of national needs and problems, an analysis of the extent to which existing programs assist in meeting these priorities, recommendations for changes in the overall Federal effort where necessary, and a report on budget coordination efforts. The Administrator of the National Oceanic and Atmospheric Administration was named to lead this effort, in consultation with other Federal agencies having ocean pollution, research, development, and monitoring responsibilities.

An interagency committee was established. I chair that committee and Dr. Stephen Gage, Assistant Administrator for R. & D. at the Environmental Protection Agency, is vice chairman.

Using subcommittees, a task force, and several workshops, the first 5-year plan was developed along with a catalog of Federal ocean pollution research development and monitoring programs for fiscal years 1978–80. These documents have been provided to this subcommittee.

The several hundred individual statements of ocean pollution research, development, and monitoring needs and problems set out in the plan form the framework within which the priorities required by the act were established. They reflect the many facets of the ocean pollution problem.

National needs and problems were identified through an extensive review of agency missions by the interagency committee and through workshops involving industry, State and local government representatives, environmental groups, and other interested constituencies. As called for in section 4 of the act, initial priorities were established for major ocean use activities that may cause pollution. High-priority areas included land use practices, outfalls of municipal sewage, disposal of industrial waste, disposal of radioactive waste, steam electric powerplants, disposal of dredged material, oil and gas development, marine transportation, and the control and mitigation of pollution.

These initial priorities are not intended to replace those of individual departments and agencies. Rather, they are intended to be used, first, as guidance in assuring that all of the areas of most critical concern are addressed somewhere in the Federal effort; second, as the primary criteria for financial assistance to be made under section 6 of the act, and finally, as an additional tool to be used in the evaluation of mission-related activities.

The plan recommends a number of tasks to improve the overall effectiveness and efficiency of the Federal effort. Important research areas are identified in which more emphasis should be placed within existing resources to a large degree, including:

Effects of synthetic organics on human health; identification of critical habitats for living marine resources; determining the potential impact of pollution on marine recreation; the cumulative effects of coastal land use practices; specific pollution problems related to industrial waste disposal and municipal sewage outfalls; specific problems related to the control and mitigation of ocean pollu-

tion, and in particular, improved tools for assessing the damage from oilspills; the need for long-term studies on natural, unpolluted areas in order to distinguish natural variations from pollution-caused changes; development of an improved capability to assess the social and economic consequences of pollution; better methods and approaches to identify potential pollutants and to evaluate risks.

Both NOAA and the interagency committee have taken important steps to implement recommendations of the first 5-year plan. To provide a national focal point for coordinating Federal efforts on a day-to-day basis, NOAA has established the National Marine Pollution Program Office within its Office of Policy and Planning. This new office, which is staffed by NOAA and interagency representatives, is responsible for updating the plan every 2 years, implementing the recommendations, and providing staff support to the interagency committee.

The next 5-year plan is due February 15, 1981. We are proposing a legislative change to extend the deadline for submission of the plan from February 15 to April 30. We believe such an extension is necessary to assure adequate review of the plan by the executive branch on a schedule which promotes better coordination of the plan with the budget process.

The interagency committee is committed to seeing that the next 5-year plan builds upon this first plan to improve its quality and usefulness and is taking a number of steps to do so. First, agencies are developing 5-year planning prospectuses for their major program areas to allow the next plan to better project future directions and levels of emphasis.

Second, a series of regional workshops have been scheduled for June 1980, to develop specific statements of regional needs and priorities for consideration by the interagency committee. We are using Sea Grant for this purpose.

Third, an extensive program review will be undertaken this year to determine how well Federal activities in petroleum-related research, development, and monitoring meet agency requirements and national needs. I know this is of special interest to you, Mr. Chairman.

And finally, efforts will be undertaken to improve the budget coordination process.

We have also taken a number of steps to establish a comprehensive and effective ocean pollution research, development, and monitoring program within NOAA, as required by section 5 of this act.

An appendix to my written testimony shows the pollution program breakdown, and the elements of NOAA which conduct those activities.

NOAA's diverse marine pollution-related activities, ranging from investigations of the levels of trace metals and synthetic organics in commercial valuable oil fisheries to assessment of the potential impacts of offshore oil development, have been described in detail and analyzed in the report and analysis of NOAA's ocean pollution research, development, and monitoring activities—fiscal year 1978. That analysis shows NOAA's base funding for marine pollution research, development, and monitoring activities of approximately $26 million for fiscal year 1980, with major activities underway in

the Office of Fisheries—NMFS—Office of Oceanic and Atmospheric Services, and Office of Research and Development.

To insure that those efforts are well coordinated and effective, NOAA has proposed the establishment of an Office of Marine Pollution Assessment within the Office of Research and Development.

That office would have authority to coordinate planning and budgeting of all NOAA's marine pollution activities. We are now developing a 5-year plan for NOAA's programs which will help assure that they are responsive to the priorities and recommendations of the Federal plan.

The act provides authority to fund work in high-priority areas which are identified in the Federal plan as underemphasized. Funding can be provided to academic institutions, private firms, and other Federal agencies. $1.5 million in fiscal year 1980 funds will be devoted to the program, and we will be soliciting research, development, and monitoring proposals shortly.

Section 8 of the act requires the Administrator of NOAA to insure that the results of ocean pollution research, development, and monitoring are made available in timely and useful fashion, a critical problem in our opinion.

Responsibility for that effort has been assigned to NOAA's Environmental Data and Information Service in the Office of Oceanic and Atmospheric Services.

Two major initiatives are planned. The first will be development of a central coordination and referral capability to facilitate making data and information more readily accessible to potential users. The second will be establishment of a capability to provide data and information from diverse sources in a form more suitable for analysis and assessment. This is particularly useful for the Federal Government.

That assessment capability will be directed at reducing large volumes of scientific data into forms which are more useful in making decisions on utilization, conservation, and development of ocean and coastal resources.

The Administration seeks reauthorization of Public Law 95-273 for $3 million in fiscal year 1981, and such sums as may be appropriate in fiscal year 1982. As I mentioned earlier, a legislative change is also requested to move the due date for the 5-year plan from February 15 to April 30.

This concludes my prepared testimony. I will be happy to answer questions the subcommittee may have.

[The following was received for the record:]

STATEMENT OF JAMES P. WALSH, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Mr. Chairman and Members of the Committee, I welcome the opportunity to appear today in support of reauthorization of Public Law 95-273—the National Ocean Pollution Research and Development and Monitoring Planning Act of 1978. The Act mandated that a comprehensive 5-year plan for Federal ocean pollution research, development, and monitoring programs be developed in order to provide improved planning and coordination of such programs within the Federal Government. A further purpose is to develop and disseminate information about pollution and its impact on the development of ocean and coastal resources.

This undertaking has proved to be no small task. At present, seven departments and four agencies are conducting or sponsoring nearly 1,000 discrete projects relat-

ing to ocean pollution research, development, and monitoring. Expenditures for these projects are projected to be $188 million in fiscal year 1980.

The first 5-year plan is complete and work is already well underway for revisions in 1981. We believe that the Act has made a positive contribution to improved planning in this area, but much more needs to be done. Consequently, the Administration supports reauthorization of the Act for fiscal years 1981 and 1982. I believe we have sent a bill to the Congress for that purpose.

I would now like to review for you our efforts to carry out the provisions of the legislation, and to outline our plans to improve the Plan and our programs.

*Section 4—The plan*

The Act requires the preparation of a 5-year plan which includes a detailed inventory of existing Federal programs, an assessment and ordering of national needs and problems, an analysis of the extent to which existing programs assist in meeting these priorities, recommendations for changes in the overall Federal effort where necessary and a report on budget coordination efforts. The Administrator of the National Oceanic and Atmospheric Administration was named to lead this effort, in consultation with other Federal agencies having ocean pollution, research, development, and monitoring responsibilities.

An interagency committee was established. I chair that Committee and Dr. Stephen Gage, Assistant Administrator for R&D at the Environmental Protection Agency is Vice Chairman. Using subcommittees, a task force, and several workshops, the first Five-Year plan was developed along with a catalog of Federal ocean pollution research, development, and monitoring programs for fiscal years 1978–80. These documents have been provided to this Subcommittee.

The several hundred individual statements of ocean pollution research, development, and monitoring needs and problems set out in the Plan form the framework within which the priorities required by the Act were established. They reflect the many facets of the ocean pollution problem. National needs and problems were identified through an extensive review of agency missions by the Interagency Committee and through workshops involving industry, state, and local government representatives, environmental groups and other interested constituencies. As called for in Section 4 of the Act, initial priorities were established for major ocean use activities that may cause pollution. High priority areas included land use practices, outfalls of municipal sewage, disposal of industrial waste, disposal of radioactive waste, steam electric powerplants, disposal of dredged material, oil and gas development, marine transportation, and the control and mitigation of pollution.

These initial priorities are not intended to replace those of individual departments and agencies. Rather, they are intended to be used (1) as guidance in assuring that all of the areas of most critical concern are addressed somewhere in the Federal effort, (2) as the primary criteria for financial assistance to be made under Section 6 of the Act, and (3) as an additional tool to be used in the evaluation of mission-related activities.

The Plan recommends a number of tasks to improve the overall effectiveness and efficiency of the Federal effort. Important research areas are identified in which more emphasis should be placed within existing resources to a large degree, including:

Effects of synthetic organics on human health.

Identification of critical habitats for living marine resources.

Determining the potential impact of pollution on marine recreation.

The cumulative effects of coastal land use practices.

Specific pollution problems related to industrial waste disposal and municipal sewage outfalls.

Specific problems related to the control and mitigation of ocean pollution, and in particular, improved tools for assessing the damage from oil spills.

The need for long-term studies on natural, unpolluted areas in order to distinguish natural variations from pollution-caused changes.

Development of an improved capability to assess the social and economic consequences of pollution.

Better methods and approaches to identify potential pollutants and to evaluate risks.

Both NOAA and the Interagency Committee has taken important steps to implement recommendations of the first Five-Year Plan. To provide a national focal point for coordinating Federal efforts on a day-to-day basis, NOAA has established the National Marine Pollution Program Office within its Office of Policy and Planning. This new office, which is staffed by NOAA and interagency representatives, is responsible for updating the Plan every two years, implementing the recommendations and providing staff support to the Interagency Committee.

The next Five-Year Plan is due February 15, 1981. We are proposing a legislative change to extend the deadline for submission of the Plan from February 15 to April 30. Such an extension is necessary to assure adequate review of the Plan by the Executive Branch on a schedule which promotes better coordination of the plan with the budget processes.

The Interagency Committee is committed to seeing that the next Five-Year Plan builds upon this first plan to improve its quality and usefulness. In this regard, agencies are developing five-year planning prospectuses for their major program areas to allow the next plan to better project future directions and levels of emphasis. Second, a series of regional workshops have been scheduled for June 1980 to develop specific statements of regional needs and priorities for consideration by the Interagency Committee. We are using Sea Grant for this purpose. Third, an extensive program review will be undertaken this year to determine how well Federal activities in petroleum-related research, development, and monitoring meet agency requirements and national needs. I know this is of special interest to you, Mr. Chairman. And finally, efforts will be undertaken to improve the budget coordination process.

*Section 5—Comprehensive NOAA program*

We have also taken a number of steps to establish a comprehensive and effective ocean pollution research, development and monitoring program within NOAA, as required by section 5 of the Act. There is an appendix that shows the pollution program breakdown and which elements of NOAA conduct those activities. NOAA's diverse marine pollution-related activities, ranging from investigations of the levels of trace metals and synthetic organics in commercially valuable oil fisheries to assessment of the potential impacts of offshore oil development, have been described in detail and analyzed in the Report and Analysis of NOAA's Ocean Pollution Research, Development and Monitoring Activities-fiscal year 1978. That analysis shows NOAA's base funding for marine pollution research, development, and monitoring activities or approximately $26 million for fiscal year 1980, with major activities underway in the Office of Fisheries, Office of Oceanic and Atmospheric Services, and Office of Research and Development. To ensure that those efforts are well coordinated and effective NOAA has proposed establishing an Office of Marine Pollution Assessment within the Office of Research and Development. That Office would have authority to coordinate planning and budgeting of all NOAA's marine pollution activities. We are now developing a 5-year plan for NOAA's programs which will help assure that they are responsive to the priorities and recommendations of the Federal Plan.

*Section 6—Financial assistance*

The Act provides authority to fund work in high priority areas which are identified in the Federal Plan as under-emphasized. Funding can be provided to academic institutions, private firms and other Federal agencies. $1.5 million in fiscal year 1980 funds will be devoted to the program, and we will be soliciting research, development, and monitoring proposals shortly.

*Section 8—Information Dissemination*

Section 8 of the Act requires the Administrator of NOAA to ensure that the results of ocean pollution research, development, and monitoring are made available in timely and useful fashion, a critical problem in our opinion. Responsibility for that effort has been assigned to NOAA's Environmental Data and Information service in the Office of Oceanic and Atmospheric services. Two major initiatives are planned. The first will be development of a central coordination and referral capability to facilitate making data and information more readily accessible to potential users. The second will be establishment of a capability to provide data and information from diverse sources in a form more suitable for analysis and assessment. This is particularly useful for the Federal government. That assessment capability will be directed at reducing large volumes of scientific data into forms which are more useful in making decisions on utilization, conservation, and development of ocean and coastal resources.

The Administration seeks reauthorization of Public Law 95-273 for $3.0 million in fiscal year 1981 and such sums as may be appropriate in fiscal year 1982. As I mentioned earlier, a legislative change is also requested to move the due date for the Five-Year Plan from February 15, to April 30.

That concludes my prepared testimony. I will be happy to answer questions the Subcommittee may have.

NOAA MARINE POLLUTION PROGRAM FUNDING SUMMARY

[In millions of dollars]

| | Fiscal year— | |
|---|---|---|
| | 1980 | 1981 |
| MESA (RD): | | |
| New York Bight | 1.8 | 1.8 |
| Puget Sound | 1.3 | 1.3 |
| Ocean dumping (RD) | 2.9 | 2.9 |
| Habitat investigations (F) | 5.0 | 7.6 |
| Great Lakes (RD) | 2.5 | 2.5 |
| Sea grant (RD) | 2.7 | 2.7 |
| Microconstituents (F) | 1.2 | 1.2 |
| Ocean engineering (RD) | 0.3 | 0.3 |
| Long term effects (RD) | 4.8 | 4.8 |
| Public Law 95–273 (PP, RD, OAS): | | |
| Section 4 | 0.6 | 0.6 |
| Section 5 | 0.1 | |
| Section 6 | 1.5 | 1.7 |
| Section 8 | 0.1 | 0.7 |
| Hazardous materials response (RD) | 1.0 | 1.0 |
| Total | 25.8 | 29.1 |

Mr. STUDDS. I guess, fundamentally, the most obvious question is: So what? We have the first plan now. As you say, it has an extremely nice cover.

The real question is: What is any different in the field of ocean pollution research and monitoring than it would have been, had we not enacted this act in the first place? Has it really made a difference of substance, in your judgment?

Mr. WALSH. I believe it has, for one simple reason. Before the legislation was passed, it is fair to say that no one in the Federal Government had any idea of what was going on in this field.

Now that we have an idea of what is going on, and we have also taken the time to identify what our needs ought to be. We have a far better basis for making planning and budgeting decisions than we did in the past.

What might have happened in the past is that the field staff of NOAA or EPA would decide to see if they could sell a program to their bosses. The program then might have come up the system. The bosses would not have had enough time to look at it, and by the time it was approved, no one could have been assured of what they had approved.

With this plan, we give the decisionmakers at the senior management level, as well as the budget level, an opportunity to look at the budget recommendations that come up from the field. The senior managment can now say, "If I am going to approve this research I want you to assure me that the following agency does not do it, and that it is aimed in the right direction." It is an extremely useful document for that purpose.

I find it particularly useful when assessing requests that come to me for funding. Sometimes these requests reach $100 million. Before this document, I had a heck of a time. I might have called up somebody I knew for information. But this document is so useful for me. It is almost indispensable for a manager. It helps us identify the areas that need to be addressed.

I think that your question really relates to how quickly the Federal Government reacts. My experience is that the executive branch's calendar is usually 2 years behind the legislative calendar because of the bureaucracy involved. Consequently, I believe that while change is hard to see now, within a year or two more, you will see our programs begin to become more responsive to the statements from the Congress about what the national needs are.

We will be able to give you a lot more information about things such as drilling muds. This plan is a much better technique for improving the helter-skelter planning process that is underway in the Federal Government.

Mr. STUDDS. Do you have any way of knowing whether any other agencies view it the way you do and use it to the extent that you do?

Mr. WALSH. Yes, we have heard that it is being used by budget examiners throughout the Government.

Mr. STUDDS. Did you find—and I expect you did—duplication where no one knew it existed in terms of the application of research effort?

Mr. WALSH. Yes, sir. There are programs that look like they are overlapping, and we have indicated that we think that those either ought to be sorted out or changed or new projects should be undertaken in certain areas.

Mr. STUDDS. When you find such things, I guess all you can do, and all that can be done under this program, is to make it abundantly clear, and hope that in turn they will make the riqht judgment.

Mr. WALSH. Yes, sir.

We respect the fact that power in the Federal Government is decentralized through many committees, agencies, bureaus, and offices; and we certainly are not going to tell them they must cut it out.

But once the information is down on paper, and you have a document to use a tool for evaluation——

Mr. STUDDS. I hope somebody has the authority to say, cut it out, if three agencies are doing the same thing.

Mr. WALSH. I think more and more senior managers are saying, "If somebody else is doing it, let's not do it. If we need to get into a gap area, let's go for it." I think what it does is give senior management in the Government a better handle.

Mr. STUDDS. How substantial a change would you anticipate in next year's version of the 5-year plan, the first revision of it?

Mr. WALSH. I think it will be a lot more refined. First of all, we will have a much better idea of how much each agency is planning 5 years down the line. We have established general guidelines.

In addition, we are going to get into, in more depth, the largest area, petroleum, and begin to get down to project levels and to program purposes. There is a lot of money going into petroleum. Energy has become the budget watchword. People down the line say that energy is selling this year, and we need to do some pollution studies.

The cumulative impact is that there are a lot of programs which are not coordinated. Through this plan we think in the petroleum

area we will be able to tell you where the problems are and how we will have to redirect ourselves.

Mr. STUDDS. Do you think there is really a need to mandate that this be done every 2 years?

Mr. WALSH. I believe there is a need, simply because it is very simple for people to fall back into traditional habits of taking a shortcut. NOAA has had the same tendency. For example, NOAA is charged with coordinating meteorology in the Federal Government under an OMB order. Recently, we discovered that we and other agencies had fallen asleep on how much time we put into it.

I find that the demands of legislation are extremely helpful to keep this thing at the front burner, because so many things come along to make it look like it should go on the back burner.

I find it useful to have that requirement, and to, quite frankly, have the pressure from Congress.

Mr. STUDDS. I am intrigued to hear you say that, because I expect, with the plethora of reports that are mandated by the Congress on a regular basis, that someone's eye will be caught by this little innocuous bill on the floor and that person will say we are just requiring another report; and are we doing anything other than creating more paper, and perhaps a few more staff positions to fulfill yet another essentially formal but not particularly substantive mandate of Congress.

I take it you feel very strongly that is not the case?

Mr. WALSH. No, sir. I think the critical thing is the process that has been created. The process is as good a one as can be put together, given the dispersion of power in the Federal Government.

When you say reports, I think of something telling you what we did last year. What we are trying to do with the plan is tell us what to do next year. I think there is a critical difference.

I don't like to file reports about what we did last year. It takes a lot of time. I prefer to look into the future, and in my opinion, anything that helps us look better into the future is a good report if it is done right.

Mr. STUDDS. In your judgment, the time that you and your associates have had to devote has been time well spent, and not time spinning wheels?

Mr. WALSH. I believe so. It has completely changed the way NOAA has done business in pollution. Three years ago I remember when NOAA appeared before Congress, they were not sure what everybody else was doing.

We now have a group that manages all of NOAA pollution programs across the board. We establish a priority ranking of new funding on a collegial basis. We do it through the senior management level.

It has rationalized NOAA's research. We can tell you what we are doing and where we are going and where we want to head.

Mr. STUDDS. Do you know whether other agencies are doing this? How about EPA?

Mr. WALSH. We understand that they are. It is being used by all the agencies in this manner, as well by as their budget examiners.

The Interior Department has been quite supportive of this, and their programs are a very large part of it. We understand that it has been very useful.

Mr. STUDDS. I am encouraged. My interest in this question was spurred by hearings in Hyannis when we actually had Federal agencies arguing on the witness stand as to who was responsible for what under the law.

There was disagreement between NOAA and EPA and Interior about who was responsible for assessing damages after a major spill. There seemed to be general agreement that the Coast Guard was responsible for cleaning it up, but beyond that there was disagreement. I guess that is as good an example as any.

Mr. WALSH. Yes, sir. Since that time, what we have done in the Federal Government is recognized that that was a completely valid criticism. First we needed to decide who was going to be the chief and who would be the Indians, and then decide what all our tribes were doing, and how to do it without stepping on each other's toes. It is not an easy task in the large, cumbersome bureaucracy that we have.

Mr. STUDDS. I think the next level, for example, using the incident of a major oil spill such as that, as the result of this program, we now know who was responsible, even though there is some overlapping. Or is there some clarification?

Mr. WALSH. There has been clarification.

Mr. STUDDS. Someone is now responsible other than just knowing who is responsible?

Mr. WALSH. Yes. We will make that even more clear as we move down the line to the agency prospectuses. We will be able to tell you the lead agency for drilling muds will be the Department of the Interior. That will be their job.

Mr. STUDDS. For research?

Mr. WALSH. For research. If, however, that agency feels they do not have the expertise and might like to turn to some other agency, we will be able to do that.

Mr. STUDDS. For example, if there is a major oil spill, is it clear, or do you know whether or not it is clear, which agency has the responsibility for long-term damage assessment?

Mr. WALSH. Well, at the present time, based on decisions that have already been made, NOAA is in charge of damage assessment.

Mr. STUDDS. For monitoring over time?

Mr. WALSH. Yes; and I believe the national response team is considering right now and recommendations have been made, that NOAA be officially designated the lead agency.

Mr. STUDDS. I notice that you have in your ranking of priorities, or in the plan's ranking of priorities, you sort of have three levels, high, medium and low, and you do not attempt to rank within those broad categories.

Mr. WALSH. No, we did not. But if you will notice, we went beyond just the initial priorities. We made some detailed recommendations in the back of the document which break it down by type of activities, by regional bases, and by pollutant.

Mr. STUDDS. And you do rank in your subheadings underneath your broad categories.

Mr. WALSH. Yes, in the back we put whether it is high or medium or low.

Mr. STUDDS. My first reaction is that you avoided some critical areas in terms of national needs. But that is probably, at least in part, a part of the difficulty you have as an interagency committee, each of whose members must be watching their own area and not wanting to be outranked by someone else.

Mr. WALSH. Even this ranking was extremely contentious and there are some people who would like to throttle me at the present time.

Mr. STUDDS. I can imagine.

But I wonder, if we did not have that difficulty do you think a purpose would be served by a greater specificity of ranking within the broad categories?

Mr. WALSH. The way the Federal Government does that kind of thing is to set these broad spectrums, and then each year go with a ZBB ranking. But it is very rare that you get a ZBB ranking across the board.

Mr. STUDDS. What kind of ranking?

Mr. WALSH. Zero-based budgeting; I am sorry.

Mr. STUDDS. I am not sure that would be desirable. You would kick up a horrible fuss among people who feel they deserve to be higher or lower.

Of course, I have my own particular parochial questions of you. In your high category you have oil and gas, and in your subheadings, ranked within that category, you have A, B, and C priorities.

In your lower priorities are discharges from drilling. That is a B, and the effects of spilled oil is a C. How does one determine those are B and C, as opposed to A?

Those are on page 136 of the plan.

Mr. WALSH. I think those rankings were judged on what we are presently doing, how much money we are putting into it now, the need to focus more in this area than in that area, and how much capability there is in the research community. The interagency team that went over this spent a good deal of time on it.

I would guess that many of these things are changing. That is why we would like to revise the plan over time. We are trying to perceive what the national needs are as they evolve. Of course, the national needs seen by this Congress today are a lot different than what they saw 2 years ago.

Mr. STUDDS. To say nothing of what they will be next year.

Mr. WALSH. So we feel that we do take a snapshot and make judgments at a certain period of time, and therefore, we would like every 2 years to improve them.

Mr. STUDDS. Do you, if pressed personally or officially, have any substantive changes to recommend in the statute other than those relatively minor ones?

Mr. WALSH. The title.

Mr. STUDDS. I was saving that for the end.

Mr. WALSH. I think that presently the legislation is fully acceptable to us, except for the change to the April 30 date.

Mr. STUDDS. Does the administration have an official position as to what the title ought to be?

Mr. WALSH. No.

Mr. STUDDS. Do you have one personally?

Mr. WALSH. We were talking about this today, and we were thinking about conducting a lottery of some sort.

Mr. STUDDS. That is dangerous.

Mr. WALSH. We could ZBB the names. The National Ocean Pollution Planning Act would be just as acceptable.

Mr. STUDDS. I think some consideration should be given to the resulting acronym. Was it you or the Department of State who came up with the suggestion for Fishery Conservation and Management Act of Basic Understanding Governing Offshore Fisheries? Was that the State Department?

Mr. WALSH. Ours was Governing International Fisheries Treaties.

Mr. STUDDS. Do you have anything better to suggest than that? I understand we may have difficulty with the Science Committee, who shares jurisdiction over this.

Mr. WALSH. I think the Senate would say it is the House language that came out.

Mr. STUDDS. Is this something you bear responsibility for in your earlier incarnation?

Mr. WALSH. Yes, I drafted that.

Mr. STUDDS. And you have had to live with that?

Mr. WALSH. Every now and then you have to see if what you suggested makes sense, and try to carry it out.

Mr. STUDDS. It is a humbling task, but we will attempt to do better. We will have informal consultations with the administration, and we will not ask most of the affected 11 agencies. We will do our very best to come up with one.

I want to thank you. I must say, when I first encountered the statute with any degree of closeness, I was extremely skeptical that we had done anything more than mandate a little more reporting on your part to us.

But you sound genuinely convinced that we have stimulated something worthwhile.

Mr. WALSH. I think it is working, Mr. Chairman. I think this kind of exercise is extremely useful for one simple reason, and that is that the decisions about funding tend to be made on an isolated basis. It is only rarely that the Office of Management and Budget will make a crosscut—that is, they will take a look at what like programs are going on.

Most budget examiners do not like crosscuts. Crosscuts are difficult and complex. This provides a very useful technique and process for us to do a relatively good crosscut and comparison. At least we know what everyone else is doing, and we will not step on their toes.

Mr. STUDDS. That is very encouraging.

Mr. Pritchard has asked permission to submit questions in writing. His job will be to keep away those from his side that will be trying to look for ways to save a little bit of money as we try to get this bill on the floor.

Thank you very much. The subcommittee stands adjourned.

[The following was received for the record:]

QUESTIONS FROM MR. MURPHY AND ANSWERS

*Question 1.* In establishing priorities, how were the trade-offs made between cost to gather the information vs. the value of the resulting data (Sec. 4(b)(1)(B))?

Answer. In developing the procedures for setting initial priorities for the First Plan, it proved impossible with the time and resources available to quantitatively estimate either the cost of projected research, development, and monitoring needs or the value of information to be obtained with any degree of reliability. Rather, a set of criteria were applied in a qualitative way to set both the priorities for specific need statements and overall categories. These criteria are:

Immediacy of the pollution threat.

Value and importance of the polluting activity to society and the economy.

Distribution of the polluting activity, whether local, regional, or global.

Value of the resources at risk.

Likelihood of solving the problem in the near term, the availability of scientific expertise, and cost effectiveness.

*Question 2.* In determining national priorities, what criteria were used to evaluate the adequacy of the level of effort (i.e. when is the research base adequate)?

Answer. Priorities were established using the criteria presented in the answer to question No. 1 without any consideration of the adequacy of existing scientific and technical knowledge of the problem area. Only after priorities were established was the adequacy of the information base and the current program level considered to determine unmet high priority needs. The current state-of-knowledge was evaluated by the interagency task force with reference to numerous recent reports on different pollution areas such as the Estes Park report, "Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution".

*Question 3.* Could specific examples be given as to how other agencies have used this Plan? How has this Plan made a difference in the *process* by which research priorities are determined and the *content* of agency research programs?

Answer. NOAA and EPA are examples of two agencies that are using the Plan to develop their current programs for fiscal year 1982. Because the Plan brought together for the first time program information on all agencies, a major benefit has been the awareness of the magnitude and emphasis of the ongoing Federal effort. A major accomplishment in the process by which research programs are developed is implementation of Task 23—the preparation of a 5-year prospectus by each agency. For the first time, many agencies are developing research strategies that look out 2-3 years beyond the most current budget year. The Plan was published in the fall in 1979 and it is much too early to determine what impact it has had on the content of agency programs.

*Question 4.* Can specific examples be given of the clarification of agency roles that have resulted from the development of this Plan (as mentioned before the Subcommittee)?

Answer. As noted in the answer to Question No. 3, a major accomplishment of the first Plan was the review, for the first time, of all agency missions, mandates, and research activities. This has resulted in clarification of agency responsibilities for all facets of pollution research, development and monitoring. As the second Plan is prepared, it is hoped that agencies will take on "lead agency" roles for pollution problem areas which are of interest to more than one agency. The National Marine Pollution Program Office is working with individual agencies to develop those lead agency roles.

*Question 5.* What interagency research programs have resulted or are in the planning stage as a consequence of the development of the Plan? How are resources to be used more effectively to support management decisions?

Answer. Because of the way the budget cycle is structured it is too early to expect that specific research programs will have been developed in response to the Plan. NOAA, through its Section 6 Financial Assistance program, is planning to spend $1.5 million on programs to address the unmet priority problems identified in the Plan. A specific interagency program on the marine pollution problems related to coastal land use practices is being jointly sponsored by the National Marine Pollution Program Office, Office of Coastal Zone Management, and the U.S. Department of State. An interagency working group is looking at the problems of quality assurance across all agency programs and their recommendations should lead to specific programmatic changes.

*Question 6.* What role does NOAA have in conducting research on the effects of ocean dumping of dredge spoil and sewage sludge (vs. EPA and the Corps of Engineers)? What research efforts are planned to carry out the research priorities cited in the Plan for these two problems? How are they to be coordinated with the appropriate regulatory agency?

Answer. NOAA's role in conducting research on the effects of ocean dumping of dredge material and sewage sludge is to carry out programs of research on fate and effects, conduct environmental assessment studies, and develop and implement monitoring strategies. These studies and activities are responsive to the known concerns and interests of EPA and the Corps. Current needs include alternative disposal methods for dredged material, such as "capping", and assessing procedural methods, such as bioassays. Recently, a special EPA/Corps/NOAA task force was established to consider the current controversy affecting dredging in New York Harbor. The task force is determining criteria for selection of test organisms, sediments to be tested, pollutants to be screened (in addition to PCBs) and bioassay procedures, in the New York Bight.

Research planned in connection with dredged material and sewage sludge disposal in fiscal years 1980 and 1981 addresses the priorities set forth in the Federal Plan. These studies will include experimental dumps in the dredge site in the New York Bight in conjunction with the Corps of Engineers and studies in dredged spoil disposal sites in the Gulf of Mexico and Chesapeake Bay. Operational monitoring of the sewage sludge site in New York Harbor will be initiated this spring and will continue for a period of years. In addition, monitoring of the sewage sludge dumpsite by the City of Philadelphia is planned to ascertain residual effects and recovery factors.

Examples include joint definition of problems, development of strategy, joint experimental work and initiation of studies in direct response to other agencies' requests. Coordination also occurs through periodic meetings or through symposia, both national and international. Finally, coordination on overall priorities and strategies within the framework of the Federal Plan will be handled through regional workshops on marine pollution assessment and monitoring.

*Question 7.* What effort is NOAA making to develop better testing and monitoring procedures and strategies (as mentioned in the Plan) that can be used for determining potential environmental degradation (e.g., from dredge soil and sewage sludge)?

Answer. Improved testing and monitoring procedures and strategies evolve both from findings resulting from programs of research at specific sites and through investigations designed to yield results that can be applied to more than one site. For example, in the New York Bight, data on dissolved oxygen concentrations and contaminant concentrations in sediments and selected organisms, have been incorporated into a comprehensive monitoring plan addressing the problems peculiar to that situation. Other work includes transfer of contaminants from sediments and the water column to organisms (Texas A&M) and studies on changes in species composition of planktonic communities (University of Maine, University of Maryland).

*Question 8.* How does this Plan differ from other reports from scientific workshops on marine pollution research needs?

Answer. Section 4 is very specific as to the content of the Federal Plan: a statement of national needs and problems; an ordering of those needs and problems a description of the current Federal Program; an evaluation of how well the current Federal program meets priority needs and problems; and recommendations to improve the effectiveness and efficiency of the Federal effort. The focus of the Federal Plan is to improve the responsiveness of Federal activities in research, development, and monitoring to the needs of decisionmakers at both the Federal and non-Federal levels. The Plan differs from scientific workshop reports by setting priorities among the research needs and by relating those needs to agency missions and mandates.

*Question 9.* It was stated that the recommendations should be accomplished primarily within existing resource levels. How was it determined that this is feasible?

Answer. Immediate actions to fill gaps in the Federal program are expected to be taken by application of the Section 6 Financial Assistance funds. $1.5M is available in fiscal year 1980. In reviewing the overall level of funding and projected increase, the interagency committee members agreed that resource levels were probably adequate to meet unmet, high priority needs. A number of areas were identified on page 10 of the plan where considerable effort is now underway but it is unclear that these efforts are well-coordinated. Improved efficiencies in these areas could free up funds to address gap areas.

*Question 10.* What national needs and problems related to social, economic, and environmental values of ocean and coastal resources were identified? What plans are being made and by which agency to address these needs? When these values are identified and evaluated, how are they to be incorporated into the implementation of the Plan's research program.

Answer. Several hundred individual statements of ocean pollution research, development, and monitoring needs and problems related to social, economic, and envi-

ronmental values are set out in Chapter III of the Federal Plan. Because of the complexity of the overall ocean pollution problem, these needs and problems discussions are presented from several perspectives:

Effects of ocean pollution on human health, living resources, recreation and aesthetics, including statements of regional needs and problems.

Activities that cause marine pollution.

Tools for evaluating ocean pollution, including research, monitoring, technology development, measurement technology, quality assurance, and date and information management.

Tools for controlling and minimizing ocean pollution.

The unmet, high priority needs are identified on pages 7-9 of the Federal Plan. Agencies are asked to respond to those unmet needs as agency program plans are formulated particularly for fiscal year 1982 but no specific assignments are made. The National Marine Pollution Program Office is working with individual agencies to identify specific program steps that will be responsibe to the unmet, high priority needs.

*Question 11.* What criteria does NOAA use to determine which high priority research topics to emphasize, what degree of effort should be directed toward each, and what the timing of the research products should be?

Answer. NOAA uses several approaches towards determining research priorities, level of effort, and timing of research products. The Federal Plan now serves as a guide for the development of research needs and priorities. In addition to this guidance, NOAA seeks the advice of academic institutions and regulatory agencies such as the Corps of Engineers and EPA. Workshops have been held to solicit this information. Examples are: the Estes Park Workshop on Scientific Problems Relating to Ocean Pollution, the Crystal Mountain Workshop on Assimilative Capacity, and the Regional Workshops on the Long-Range Effects Program. Some projects have advisory committees consisting of panels addressing user needs (products and timing), science and technology (technical design), and citizens and industry (public awareness and problems).

The advice gained from these workshops and groups are then considered in the context of NOAA goals, objectives and resources for making decisions and program content.

*Question 12.* When identifying research needs and agency responsibilities, what role did NOAA define for herself in supporting other agencies' regulatory needs (e.g., EPA, Corps of Engineers)? How does NOAA ensure that research programs and results will be appropriate and timely for management decisions? Please include specific examples.

Answer. There are numerous ways which NOAA can and has supported other agencies' regulatory needs. These include providing at-sea research capabilities, scientific assessments of particular sites or problems, and research relating to pollution problems and ecosystem functions. NOAA is an active participant in the national marine pollution program, and is aware of most of the time frames for management decisions surrounding basic issues. Consequently, we are in a position to anticipate the need for information at specific times. In addition, we seek guidance from the regulatory agencies in order to assure that we will be responsive. The workshops and advisory committees mentioned in Question 11 are examples of some of our interactions in this regard. We also established formal arrangements with EPA and the Corps of Engineers for the purposes of improving NOAA's responsiveness to their needs. The following list provides examples of NOAA's responsiveness to important management decisions:

1. NOAA temporarily redirected the activities of the MESA New York Bight Project to assist in the selection of the alternative sewage sludge dumpsite, at the request of EPA.

2. NOAA, partially at the request of EPA, conducted research into the causes of the Long Island beach pollution incident and the 1976 oxygen depletion episode off the coast of New Jersey.

3. NOAA, at the request of EPA, developed routine water quality monitoring cruises in the Bight during the summer months.

4. NOAA provided ship support in 1974 to the initial testing of the concept of high-temperature incineration of organochlorides (Gulf of Mexico).

5. NOAA participates on task teams established to investigate area problems, e.g., in the case of PCB testing of dredge spoil in the New York Bight.

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### Question From Mr. Hughes and Answer

*Question 1.* The Federal Plan for Ocean Pollution Research, Development, and Monitoring, fiscal year 1979-83 relegates sewage sludge dumping to a low priority

(p. 5). In view of the severe adverse environmental impact that the ocean dumping of municipal sewage sludge has caused in the ocean waters of the New York Bight, this low priority is both suprising and disturbing. I would like to know the reason for assigning sewage sludge dumping to a low priority in the Federal Plan.

Answer. The national policy for the ocean dumping of sewage sludge is that it will cease in 1981. Given the extensive research that has occurred over the last decade, the local nature of the problem, and the current legislated policy, the interagency committee members agreed that a low priority should be placed on the research needs in this area.

QUESTIONS FROM MR. PRITCHARD AND ANSWERS

*Question 1.* What work has been done on the criteria for the selection of sites for sub-seabed nuclear waste disposal?

Answer. Several years of DOE-sponsored work have been devoted to establishing criteria for the selection of sites for sub-seabed nuclear disposal. The major criteria are that: the sea floor chosen be of long-term stability; it be covered with a thick layer of sediment; and it be at any abyssal depth. The best sites, therefore, would be in abyssal hill regions at the center of tectonic plates, with a 5 to 100 meter thickness of red clay sediment.

*Question 2.* Is any work being done to map proposed sites? What type of mapping and profiling will be done?

Answer. Some work has been conducted using conventional echo sounders for defining the surficial shape of the seafloor, and high energy sonic profilers for subsurface structure. Finer scale mapping will have to be obtained over the sites, when selected.

*Question 3.* Based on the work up to this date on seabed disposal of radioactive waste, are there any studies which conclude that seabed is not viable and we should not conduct further studies?

Answer. To our knowledge, five years of research have yielded no technical reasons why seabed disposal should not be studied further, and considered as a viable disposal option.

*Question 4.* Has any work been conducted on the method of waste implementation in the deep seabed in geologically inactive sites?

Answer. Yes. The method currently being discussed is to use elongate conisters that would penetrate the sea floor and bury themselves in the sediment.

Other alternative strategies are being considered including free-fall penetration, jet assist, and drilling.

*Question. 5.* Would we have to develop new technology for the transportation and disposal of radioactive wastes?

Answer. New technology for the transportation and disposal of radioactive wastes will in all probability need to be developed. This is of particular importance for the deployment of the canisters so that penetration in the sediments can be achieved safely and effectively.

*Question 6.* Are there any methods of retrieving implanted waste canisters from beneath the seabed if the need arises?

Answer. To our knowledge there are no proven methods of retrieving implanted waste canisters from beneath the seabed if the need arises. Such methods will need to be devised if retrieval in the future is a consideration.

*Question 7.* Does NOAA have the capability to monitor the entire disposal process should sub-seabed disposal become a viable option?

Answer. Yes, provided Class I ships can be dedicated when such disposal operations are taking place. Ships of that size are needed to tow devices that can monitor the abyssal depths remotely. In situ sensors, which can be retrieved by surface vessels, will also need to be used.

*Question 8.* Do submersibles exist that can travel to the depths where disposal might take place?

Answer. The U.S. Navy's TRIESTE II is a manned-submersible that can work at depths up to 6,00m.

*Question 9.* Can the sediment withstand the high heat that nuclear waste generates?

Answer. One of the key unknowns is the behavior of the sediments. The heat emanating from a canister during its initial 500 years may cause part of the sediments to rise and parts may harden into a brick-like substance. Experiments are planned to test the response of clay sediments to implanted heat sources.

*Question 10.* What do we know about the dose rate to deep sea organisms?

Answer. We do not know very much about this problem. This is being addressed in a number of ways, including studies in areas where low-level radioactive waste have been deposited.

*Question 11.* How long can we reasonably expect the sediment to contain radionuclides?

Answer. This depends on whether or not sediments remain stable, as discussed in response to question 9, and on the tendency for nuclides to be adsorbed onto sediment surfaces. Work is proceeding to determine how adsorption is affected by heat and pressure and by the chemical form of the nuclide. If the overlying clay sediment remains stable, nuclides must diffuse through interstitial water while maintaining adsorption equilibrium with the sediment. It has been estimated that nuclides that leak from a canister at depths more than 30m into sediment may not reach the sea floor for more than one million years.

*Question 12.* What happens when radionuclides leak from the sediments?

Answer. They are subject to adsorption onto sediment, diffusion through interstitial water, possibly biological uptake if near enough to the surface and, once into the water column, to oceanic diffusion and advection.

*Question 13.* Does NOAA plan to involve the public in their analysis program?

Answer. Should it be determined that NOAA is to play a more active role in this analysis, full public participation at significant stages would be planned. It is noted that public participation has been provided for a draft EIS by DOE that includes discussion of the seabed option.

*Question 14.* What research needs to be completed? What is the time frame for research programs?

Answer. What is required is greater technical development of canister implantation and retrieval techniques, knowledge on the effect of heat on sediment stability, knowledge on biological paths for nuclide migration, and some more data on nuclide adsorption. It is estimated by DOE that a demonstration project of seabed disposal could be inaugurated in ten years.

*Question 15.* Under P.L. 95–273, does NOAA need additional funding in order to improve its coordination of the Federal research effort regarding the sub-seabed emplacement option,

Answer. There is no need for additional funding under P.L. 95–273 to coordinate the Federal research effort. Funding is needed, to accelerate the research efforts required.

*Question 16.* What should be NOAA's role in seabed disposal of radioactive waste?

Answer. The NOAA Science and Services Policy Group is considering the appropriate role for NOAA In the investigation of ocean disposal of radioactive waste. NOAA could play a supportive role to the technology planned for this disposal method. NOAA has the expertise to investigate the physics and chemistry of nuclide migration in sediments and in the ocean; the biological uptake and migration of nuclides; and disposal site surveying, selection and monitoring.

*Question 17.* Are other nations doing research on the sub-seabed emplacement option?

Answer. European nations are concerned with possible ocean disposal of high-level radioactive waste, but their commitment to study of the sub-seabed option is not as strong, as that of the U.S.

[Whereupon, at 10:47 a.m., the subcommittee adjourned, subject to the call of the Chair.]

# OUTER CONTINENTAL SHELF DRILLING ACTIVITIES OVERSIGHT

TUESDAY, AUGUST 26, 1980

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OCEANOGRAPHY,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
*Washington, D.C.*

The subcommittee met, pursuant to notice at 10 a.m., in room 1334, Longworth House Office Building, Hon. Gerry Studds presiding.

Present: Representatives Studds, Hughes, Breaux, Wyatt, Pritchard, and Carney.

Also Present: Richard Norling, Don Lippincott and Diane Hull, Subcommittee on Oceanography majority staff; Curt Marshall, Subcommittee on Oceanography minority staff; Wayne Smith, Subcommittee on Fisheries and Wildlife majority staff; and Dan Panshin, Subcommittee on Maritime Education.

Mr. STUDDS. The subcommittee will come to order. The subcommittee meets today to receive testimony from two Government agencies concerning environmental problems associated with oil and gas drilling activities on the Outer Continental Shelf.

Specifically, we have asked the Coast Guard to provide testimony concerning the present availability and capability of oil spill containment and cleanup equipment and technological improvements which might be expected in this equipment in the foreseeable future.

In part II of this hearing, we will receive testimony from the Environmental Protection Agency concerning its policy in granting discharge permits for materials used in, or incidental to, offshore drilling.

Both agencies bear particularly heavy responsibilities as frontier areas in the North Atlantic and along the Alaskan coast are opened to oil and gas development. Both areas contain some of the most productive fishing grounds in the world which not only make a significant contribution to our economy and the world protein supply, but having been harvested continually by generations of American fishermen, now form an important part of our national heritage.

Whether or not that heritage continues beyond this generation will, in no small part, be determined by how well these two agencies carry out their environmental mandates.

Insofar as the Congress has provided those mandates through various pieces of legislation, it is the responsibility of the Congress to see that its wishes are heeded and that the resources provided are adequate to the task.

I feel that today's hearing is a proper response to fulfill the subcommittee's responsibilities for environmental and technological matters concerning the oceans.

Mr. Pritchard, do you have a statement?

Mr. PRITCHARD. Yes; Mr. Chairman, I do.

## STATEMENT OF THE HON. JOEL PRITCHARD, A REPRESENTATIVE IN CONGRESS FROM WASHINGTON STATE

Mr. PRITCHARD. Mr. Chairman, the most recent studies of our Nation's future consumption and production of energy have had some promising signs. They indicate that domestic consumption of oil will most likely decrease by about 8 percent in 1990 over what it was in 1979. Unfortunately, domestic production of oil is expected to drop by even higher rates during this period, requiring the importation of about 60 percent of our oil needs in the year 1990, as compared to roughly 45 percent today.

These recent studies really do not tell us anything we have not known from other studies, however, they graphically demonstrate the need to accelerate the exploration for and development of our enormous domestic oil and gas resources.

According to the Department of the Interior, the Federal Government owns 85 percent of our remaining oil, and 40 percent of our remaining natural gas with about 60 percent of our oil being located on the Outer Continental Shelf.

We must take steps now to accelerate production of these resources, but we should not do so to the detriment of other considerations. By acting now, we have enough time to give proper consideration to all aspects of marine development. If we delay the production of oil and gas, and a crisis develops, history tells us that many safety and environmental protection programs may be subject to a considerable backlash. For the American public and for the members of the committee who have worked long and hard for the safety and environmental programs that were too long ignored, this would indeed be a catastrophe.

The safety and environmental record of the U.S. offshore oil and gas activities has been quite good. However, some questions remain to be answered. The 88-year history, as well as many studies, indicate that oil and gas operations have not detrimentally impacted commercial fisheries or other marine activities. What some of these studies have indicated, however, is that there are some questions concerning long-term impacts of drilling mud sediments, under particular conditions and at certain concentrations.

We must take every step possible within reason to assure that there is not economic displacement or irreversible harm from Outer Continental Shelf oil and gas activities that would eliminate other uses of our oceans and coastal areas.

Public Law 95-372, the 1978 Outer Continental Shelf Lands Act Amendments, provides for these considerations which is evidenced by the fact that out of six court challenges to Outer Continental Shelf lease sales in 1979, none have been successful.

There are 10 Federal departments and agencies involved in Outer Continental Shelf leasings, two of which are testifying before us today.

There is no evidence that the current Outer Continental Shelf leasing program has not and is not operating safely, but again some questions have been raised.

In looking for answers to these questions, we must remember that no responsible scientist or researcher can or will claim they can prove anything conclusively, and a negative cannot be proven at all. We must always be willing to accept some level of risk as we explore and develop resources offshore.

In light of this, and of our concern for the wise use of our coastal and ocean resources, I look forward to today's witnesses. Thank you.

Mr. STUDDS. Our first witness, on behalf of the Coast Guard, is Capt. Charles Corbett, Chief of Marine Environmental Response Division, U.S. Coast Guard. Captain Corbett, welcome. I believe we last met in Corpus Christi.

**STATEMENT OF CAPT. CHARLES CORBETT, CHIEF, MARINE ENVIRONMENTAL DIVISION, U.S. COAST GUARD, ACCOMPANIED BY MIKE CHRISTENSEN**

Captain CORBETT. Yes, sir.

Mr. STUDDS. At an earlier round of the ongoing saga of the Coast Guard oilspill cleanup capability.

Captain CORBETT. Yes, sir. Mr. Chairman and Members of the committee, realizing the large amount of our time this morning might be spent on questions, I have cut my testimony down to a bare minimum. Since it is only four pages I plan to read the entire statement.

Mr. STUDDS. Go right ahead.

Captain CORBETT. I am Capt. Charles Corbett, Chief, Environmental Response Division of the Coast Guard's Office of Marine Environment and Systems. I am accompanied today by Mike Christensen of my staff. Thank you for this opportunity to present the Coast Guard's views concerning the state of technological development and availability of containment and cleanup equipment for drilling activities on the Outer Continental Shelf.

Technological development of containment and recovery equipment has proceeded to the point where it is realistic to expect successful operation of open ocean recovery equipment in 8 to 10 foot seas and in winds of at least 20 knots. This is considered the current "state of the art" and is based on observations made of the Coast Guard's open water oil containment and recovery system used on the IXTOC I oil spill at the Bay of Campeche well site. We do not expect significant technological advances in this area since our experience indicates that this may be the outer limit at which mechanical recovery of oil is possible. This rationale is based on the premise that break up of oil and dispersion takes place in about an 8- to 10-foot sea. We have an R. & D. effort underway to develop a computer model that will predict the breakup and dispersion of floating oil slicks in rough seas.

As a result of the Presidential Initiatives of 1977, the Secretary of Transportation has approved for planning purposes a 3-year project to locate open water containment and recovery systems at 11 high risk areas around the country. Equipment would be stockpiled and maintained at facilities with the objective of attaining a

nationwide, aggregate recovery capacity of 200 tons of oil per hour, that is, approximately 1,400 barrels per hour, conditions permitting. We now have some of the equipment at each of our strike teams locations which, as you know, are located at Elizabeth City, N.C., Hamilton AFB, Calif., and Bay St. Louis, Miss.

As you are aware, it is the spiller's responsibility to control, clean up, and mitigate damages if a spill should occur. A Memorandum of Understanding between the U.S. Coast Guard and U.S. Geological Survey presently under development will task the Coast Guard with review of those portions of exploration or development and production plans which address the adequacy of the required oilspill contingency plan, including the adequacy of response, cleanup equipment and procedures. It should be noted that pending finalization of the memorandum of understanding the Coast Guard and U.S. Geological Survey have an informal agreement implementing this mechanism for lease sale 42 on George's Bank. The Coast Guard review will occur prior to approval for actual drilling. The guidelines under which we intend to conduct the review will call for oil containment and recovery equipment to be "state of the art" that is, capable of effective operation in 8- to 10-foot seas and in winds of at least 20 knots.

Since the quantity of equipment that we would require of the OCS lease operators should be related to the spill threat, a recovery capacity of at least 1,000 barrels per day should be the minimum recovery rate acceptable.

A time of 6 hours for initiating recovery operations with prestationed equipment is the target we have set. That is, whatever amounts of equipment that we require OCS lease operators have available for responding to spills should be fully deployed and in operation within 6 hours from the time the spill occurs, weather permitting. Where equipment is to be staged will be left to the operator, but he must demonstrate that the response target criteria can be met under all conditions under which the equipment is expected to be effectively operated. Within 48 hours after a spill, an operator would be expected to have any additional equipment on scene and in position to address a spill of extraordinary dimensions.

We also believe that response exercises must take place at least semiannually. At least one of these semiannual exercises must be structured to test the response mechanism under the most demanding environmental conditions in which it is expected to be effective, again 8 to 10 foot seas.

Vessels capable of deploying and operating the "state of the art" response equipment, in its maximum effective state, must also be available within the same response time parameters as used for response equipment. The crews of all candidate support vessels must be familiar with equipment deployment and operating techniques, or a system developed for supplying trained crews/supervisors to the involved vessels within the response time. In addition to oil recovery equipment, offshore operators will be required to maintain equipment for applying dispersants and adequate stockpiles of dispersants, if these are not readily available from vendors. This requirement should not be interpreted as a preference on the part of Government for the use of dispersants. Instead, it recognizes

that spills may well occur in which the mechanical removal of oil is not possible due to environmental conditions or weather conditions. Under circumstances such as these, it is desirable that all options be available. The decisions to use dispersants would of course be made using the criteria and procedures set forth in annex X of the National Contingency Plan.

In closing, Mr. Chairman, I must say quite candidly that I do not believe there now exists an in-place capability to respond to a major oil spill in the Outer Continental Shelf. However, the Coast Guard will continue to work closely with other Federal and State agencies as well as industry of course, to pursue development of adequate contingency planning for the OCS, with the reliability and the level of performance which we think desirable. I thank you and the committee members for inviting the Coast Guard to participate in these proceedings. I will be happy to address any questions you, or the other members may have. Thank you.

Mr. STUDDS. One thing we have learned is that we should never have anyone above the rank of captain testify on the part of the Coast Guard, if we want to get at some of the facts in the matter. I remember your diplomatic—how do I phrase this—your efforts at the hearing in Corpus Christi to set the record as straight as you possibly could, given the claims of some people of higher rank in the Coast Guard about the capability of the equipment.

Let me just say that I appreciate your testimony very much. I find this one of the more shocking pieces of testimony from the Coast Guard in recent years only because in my judgment it represents a complete reversal in tone, and to a large degree in substance, of what the Coast Guard is saying with respect to its capability to deal with an oil spill in the high seas on the Outer Continental Shelf. Members of this committee will recall that over the years whenever I or other members of the subcommittee have sort of pressed the Commandant, whoever he might be at the time, of the Coast Guard with respect to that capability, we have gotten, in response, a very definitive tone, with the Commandant suggesting over the years, again whichever Commandant it may have been at any given time, the Coast Guard was indeed far better prepared. The state of the art was indeed far better than the deprecatory tone of my question may have suggested. And whenever any of us here suggested that perhaps we were not equipped to deal with a major spill under routine, never mind adverse conditions in the Outer Continental Shelf. The implication was that over the years on this committee we were somehow being alarmist raising doubts. Now I think you have unequivocably, explicitly stated what it is that we feared. As you well know, your testimony tracts a letter by the Commandant of the Coast Guard to the acting chairman of this committtee dated July 16 of this year. Let me read you a couple of things and I now all I can do is ask for your opinion but I want the record to reflect very clearly what is happening here. The President sent a message to the Congress immediately after the *Argo Merchant* disaster. The *Argo Merchant* precipitated, if nothing else, a great many speeches by people in high office in the land. The President sent a message on oil pollution dated March 17, 1977. The *Argo Merchant* sinking was a December 1976 disaster as I recall. In it the President said the following:

Improvement of Federal ability to respond to oil pollution emergencies. I have directed the appropriate Federal agency, particularly the Coast Guard, the Environmental Protection Agency, in cooperation with state and local governments to improve our ability to contain and minimize the damaging effects of oil spills. The goal is an ability to respond within 6 hours to a spill of 100,000 tons.

Now let me read to you for the purposes of the record, I know you are familiar with it, from the letter Admiral Hayes sent on July 16 to Mr Ashley, acting chairman of the committee. I quote, "The national response goals established by the President March 17, 1977, oil pollution message are not being implemented by the Coast Guard, nor are we in the process of deploying high seas containment and cleanup equipment at 11 strategic sites around the United States to respond to an oil spill of 100,000 tons within 6 hours." At the very least that is refreshingly clear language that we are not complying with the directive of the President. Why not?

Captain CORBETT. Mr. Chairman, I think first of all the key phrase in the language that you read which the Commandant wrote is relating to the 6-hour element. We are, in fact—we will be locating our equipment at the sites which we have said that we would. Let me just insert into the record a short statement that I have on this, if you please. Initial emphasis on implementing the Presidential initiatives has been improving response equipment and improving operations procedures. At the time of the President's message of March 17, 1977, on rising pollution of the ocean we had no equipment which would permit the recovery of oil in seas greater than 5 feet. Since that time we have modified 13 devices for oil containment at sea and developed techniques that would permit us to deploy these devices in up to approximately 10-foot seas. There are four complete systems including pumping in our inventory. We have presently a contract for more of these devices and expect to have 26 complete systems built by the fall of 1981.

Mr. STUDDS. The fall of 1981?

Captain CORBETT. Yes, sir. These are fully budgeted and we expect to have them.

Mr. STUDDS. That is 4½ years after the President's message?

Captain CORBETT. Yes, sir.

Mr. STUDDS. At the end of Admiral Hayes' letter of last month which you tracked in your testimony almost verbatim, he states to Congressman Ashley, "Quite candidly I must say I do not believe there now exists an in-place capability to effectively respond to a major oil or hazardous substance spill on the OCS or fisheries conservation zone. It will take some time before the situation improves." That is the end of the letter.

Captain CORBETT. Yes.

Mr. STUDDS. You have a similar statement in your own testimony.

Captain CORBETT. I will just remark extemporaneously on that. I think by the time we will get our 26 skimming barriers located around the country that the Coast Guard will be in a relatively good position to attend to or address an open water spill. However, the main thrust of our activities on the Outer Continental Shelf is not to provide Coast Guard equipment but to insist—and I really mean this quite seriously—to insist that the operators have the

contingency plans, the operating procedures, the equipment to fully respond within 6 hours to an oil spill on the OCS.

Mr. STUDDS. Let me ask one other thing here and then I want to go on to other members. You and other members for the Coast Guard spokesman and I have gone round and round again as to what is the state of the art at the moment in any given year. As I understand the first page of your testimony, you think we have reached what may be the ultimate state of the art and that is the capacity to recover spilled oil in 8- to 10-foot seas in winds of at least 20 knots. You say we do not expect significant technological advances in this area since our experience indicates this may be the outer limit at which mechanical recovery of oil is possible.

Well if that is true, No. 1, that is certainly the first time to my recollection this committee has been told that that is as far as we are ever going to be able to go. You may or may not know I was in Massachusetts this last week, in the middle of the summer, in August, wind was out of the northeast on Georges Bank, for the better part of a week, the seas were running at 16 feet and the winds were steady 25 to 35 knots in the middle of the summer, a not too unusual situation. God knows what the situation will be in January, February, March. That is August. If I understand your testimony correctly you are telling us there is simply no way that we can or very possibly ever will be able to deal with a major oil spill out there under most conditions and most months of the year, is that correct?

Captain CORBETT. Everything except your last phrase, Mr. Chairman. I think the environmental impact statement indicates to us at least that we will be able to recover the oil with our equipment operating in 8- to 10-foot seas approximatley 90 percent of the time on Georges Bank. But you are quite right in the seas of 16 feet, winds 40 knots or above, there will be no oil spill recovery operations out there. Not only would the equipment not be able to operate out there, it will most likely break, the people will break. We will have people breaking arms, falling over the side, so forth. So it is a people problem as well as a mechanical problem. Plus the oil will disperse not only across but through the water column and even if you could mount a recovery operation it would be grossly inefficient because the oil would be spread in so many different directions that you could not address it. You need a lot of fine equipment, you need a lot of oil to make it operate really well. You need to become engaged with oil. If it disperses across the water or into the water column then your equipment really is not useful.

Mr. STUDDS. Your people-breaking problem occurs, I assume, on whatever vessel it is that carries your cleanup equipment, not the Coast Guard cutter.

Captain CORBETT. Right.

Mr. STUDDS. In other words if they are out there under fairly calm conditions and a storm suddenly comes up they are in trouble?

Captain CORBETT. I do not think they are in trouble as far as risking their lives, because we could get the vessels in. They would not remain out there. The vessels which are used for these kinds of operations are relatively small. People get seasick in that kind of

weather. The fumes—I know Mr. Wyatt will remember when we flew over the IXTOC spill.

Mr. STUDDS. He did not really get seasick.

Mr. WYATT. I was in an airplane.

Captain CORBETT. He will recall the fumes which we experienced at 500 feet were very noxious. This kind of thing is a people problem. This is another reason why we are talking about 8- to 10-foot seas. I really believe we can operate in that range. I also believe it will be a long time, if ever, as you suggest, that we will be able to operate in anything, say above 12-foot seas.

Mr. STUDDS. Right, and what you are saying to me is that during substantial segments of the year, and in fact during intervals even in summer under normal conditions we would not be able to deal with the spill on the Georges Bank or Gulf of Alaska or presumably other areas.

Captain CORBETT. I did not say that. I said on the Georges Bank the environmental impact statement indicates we can operate about 10 percent of the time.

Mr. STUDDS. I think you meant——

Captain CORBETT. Ninety percent of the time. Thank you Mr. Chairman.

Mr. STUDDS. Whoever wrote the environmental impact statement concluded only 10 percent of the time do the waves go over 10 feet on Georges Bank, is that right?

Captain CORBETT. That is right.

Mr. STUDDS. The person probably could not find it on the map. I suggest if they can stand repetitive things and they work in Washington which they probably do or they would not have written a statement like that, if they would turn on NOAA's weather conditions radio reports and leave it on for a few days any given month in Georges Bank, they might revise their environmental impact statement.

Mr. Pritchard.

Mr. PRITCHARD. Tell me how much have we learned in the last couple of years from more recent oil spills since we had our problem up in the Georges Bank area?

Captain CORBETT. We learned a great deal at the IXTOC 1 oil site in this matter of open water recovery. In fact we had scheduled an exercise, I think it was just a few months ahead of the time when the IXTOC 1 occurred, which was canceled because of IXTOC. We were eventually invited down to that site by Mexico to recover oil. We were quite delighted with the recovery efforts. We had some setbacks as well. I would like to read you some extracts, Mr. Pritchard, of some of the operational messages which were received from our man on the scene, Lt. Com. Jim O'Brian. Before I do that I would like to tell you a little bit about Jim. He is a Texas boy who grew up in Texas, he really has no ax to grind with anybody, he just reports the facts as they are. He is not in the business of selling equipment or anything of the sort. But he is very reliable at reporting facts as they are and really knows his business. On the 10th of August he reports:

> Failure of mooring points on initial pump sled during heavy seas prevented the establishment of the recovery system. Launched second sled and will utilize an improvised mooring design. Expect recovery/pumping ops to commence P.M. 10 August.

Containment barrier is working well. Operating in eight foot seas, 35 KT winds. Little entrainment and splash observed.

14 August 1979: Recovery rate, 265-300 GPM. Good slick inside barrier-4in.-4.5 in. deep.

In other words the barrier is containing oil.

Barrier continues outstanding performance containing oil in up to 12 foot seas. Oil has Specific Gravity of 0.92. This tends to slow down skimming rate in late afternoon. On scene WX generally constant, wind F/20KIS, seas E/3-12 ft. with subsiding of winds and seas during each 24 hour period for approx. 6 hours.

17 August 1979: Small storm center went through area two nights ago with 40KT winds. Five ton moorings were insufficient to hold system. Suction hoses torn loose from barrier, experience minor problems with other couplings. All damages repaired, system on line yesterday utilizing twelve ton moorings.

Estimate max 4,000 brls daily recovery on good day. Exercising pumping rate slow due to six hundred foot run from pumps to discharge point. Otherwise system working well.

That is poorly phrased. What it means is that they had a significant head. The surfaces for example inside the hydraulic hoses were slowing them down.

Barrier presently containing ten inches of product buildup with no entrainment or splash.

This was quite significant for us, we were delighted.

20 August 1979: 19 August 79 estimate skimming barrier pumped 6,600 barrels. Storm center crossed area late 19 early 20 Aug. 40-50 KT winds, 12 ft. seas. Recovery barge taking on water, in danger of sinking. All efforts directed at saving barge.

A barge provided by Mexico, by the way.

21 August 1979: Holding barge stabilized and pumping operations resumed at 1500 local 20 Aug 79.

One prime mover remains inop due to salt water ingestion. Flushed with diesel and oil. Other prime mover manifold welded by support vessel and now operating normally.

Pumping rate estimated at 5000 bbls average/day, with maximum of 400 to 450 GPM and minimum 250 to 300 GPM. Differences occur primarily in afternoon when prevailing wind shifts and product level decreases at barrier.

27 August 1979: One barrier parted during tropical disturbance. Appears vessel ran over it. OIC states repairs being made and anticipated no problem being on line when Pemex gives go ahead to commence pumping.

31 August 1979: NR two skimming barrier casrep due to collision with vessel. Presently in three sections. Skimming struts torn up, main tension line parted and suffered extensive fraying. Some flotation bags ripped or pulled off. Two outboard sections attached to NR one barrier as deflection barrier. Permanent repairs must await return conus.

That is about it. This kind of testimony I am inserting is to demonstrate a couple of things. No. 1, our barrier works well but it requires innovation. It requires kind of stout-hearted guys to be down there and stick with the job. But we think that we are improving it all the time, learning more about it all the time and we really think it will work in 8- to 10-foot seas. There are times, such as the *Burma Agate* incident off Texas, when it did not work well at all. We were not able to moor the system as we were at Campeche. It was necessary to use vessels to move it around. We had winds that were contrary to the current. We had not nearly so much oil as we had at Campeche. We had a hell of a big fire on our hands. So we did not find it worked so well at that particular time. We are continuing exercises on a regular basis to improve our methods of deploying this boom. So I think your question was what

is the most significant thing we have learned. I think it was down there at the Bay of Campeche.

Mr. PRITCHARD. Let me ask one other thing here. What kind of a response can you make today in the case of an oil spill in the Puget Sound area? Do you have this equipment—do you have just one skimmer or do you have a series of these things? How quickly can they be brought to the scene and what kind of skilled operators and ability do you have, say, in an area like the Straits of Juan de Fuca or Puget Sound?

Captain CORBETT. The equipment for a spill in that area would come from our Pacific strike team at Hamilton Air Force Base, Calif. It is ready to go if it is not being used some place else. It is air transportable by C-130 aircraft. I do not know the airport at which it would arrive. That element of the response time, and the people to accompany it, would be very quick and very effective, then the problem is getting it to the actual site of the spill. And also the weather.

Mr. PRITCHARD. I understand the weather, I just wonder what your capacity as far as—what is your strike team; does it involve 6 or 25 people?

Captain CORBETT. Strike teams average about 25 people. I really could almost assure you that they—again weather affects airplanes being able to take off—but 4 or 5 hours up to your area, getting into the Seattle area, then ready to press on by truck or waterborne vehicle if the weather is OK to do so.

Mr. STUDDS. Mr. Breaux.

Mr. BREAUX. Thank you, Mr. Chairman. Thank you, Captain. I would also like to commend you publicly for the work that the Coast Guard did with the chemical spill that occurred in the Mississippi River. Your obligation I guess has the supervisory jurisdiction over chemical spills in the navigable waters. Let me discuss maybe a slightly different question first. Your moneys for cleanup operations come out of what fund?

Captain CORBETT. 311K fund, established by the Clean Water Act. That is, providing it is necessary. We naturally hope that the discharger will pick up the bills. But if he does not we will certainly use the 311K fund.

Mr. BREAUX. Section 311 of the Clean Water Act provided the funds we used to clean up the IXTOC oil spill.

Captain CORBETT. That portion of the spill that reached the Texas coast, yes, sir.

Mr. BREAUX. How much of the moneys do you have left in the fund at this point approximately?

Captian CORBETT. Right now there is about $18 million in the fund.

Mr. BREAUX. $18 million. The authorization and appropriation levels are what?

Captain CORBETT. $35 million.

Mr. BREAUX. And the appropriations were what, $35 million?

Captain CORBETT. We were never appropriated $35 million. It started out at $20 million and it is a revolving fund. So we have received moneys back from dischargers, moneys back from penalties and a number of supplemental appropriations. I did not come

prepared to detail those but it has been a continuing battle, it has reached very low levels at times.

Mr. BREAUX. In general the Coast Guard will use those funds to clean up an oil or chemical spill. Then would the Government have an obligation to proceed against the person who actually caused the spill, to recover those funds?

Captain CORBETT. Yes, sir.

Mr. BREAUX. And our Government does do that?

Captain CORBETT. Yes.

Mr. BREAUX. I am interested——

Captain CORBETT. You are speaking about domestic oilspills.

Mr. BREAUX. Sure. You cannot use those funds to go clean up spills outside our territorial waters.

Captain CORBETT. Yes, we can if it is a threat.

Mr. BREAUX. It has to be a threat. Say it is somewhere off the North Atlantic moving to some other country's shoreline you would not be able to use it for that purpose?

Captain CORBETT. If in the opinion of the predesignated on-scene coordinator it poses a threat to our shoreline or waters then he could access the funds. We would not—we would let him make that judgment. But if it is headed some place else, I think the answer would be no.

Mr. BREAUX. OK. On page 1 you said that given the technological development of the recovery and containment equipment it is realistic to expect they will be successful in seas up to 8 or 10 feet and winds of 20 knots. Then you continue to say the rationale is based on the premise that the breakup and dispersion of oil takes place in about 8 to 10 feet seas. Is dispersion of and breakup of oil good or bad?

Captain CORBETT. It depends. Dispersion down through the water column can be quite harmful to aquatic life. Though I am not a biologist. But if the oil is say, take the *Argo Merchant* where the oil was being spread out and forced to seaward, then I expect that the average layman on the coast of Massachusetts would say that was good, rather than having it coming into the Massachusetts shoreline in bulk. Sometimes when we disperse oil we do it intentionally. That is not necessarily good. It might save an amenity beach but it might kill a fish or two, so there are decisions which have to be made by our on-scene coordinator as guided by the EPA and the State.

Mr. BREAUX. Do you know if the reports are finalized on the effect of the IXTOC spill as far as the biology?

Captain CORBETT. No. That is a NOAA responsibility. As you know they met some problem with funding. But I do not know the progress that they have made.

Mr. BREAUX. What about the obligation of an operator as far as a cleanup of a spill or containment of a spill, is it not their first obligation to proceed with cleanup and containment exercises?

Captain CORBETT. Yes, sir, it is.

Mr. BREAUX. And what role does the Coast Guard play? Is it a supervisory role to insure that they in fact have equipment and manpower to carry out the operation?

Captain CORBETT. Yes. The first role is exactly what you say, to be sure that they have the necessary equipment to remove the oil,

the personnel are well trained, they are exercised and in general they have a contingency plan and the wherewithal to address an oilspill on the OCS. Now although the law says that the discharger will address that spill, if he cannot do so or will not do so or is not doing it the way we think he should then we will declare a Federal response utilizing the 311 fund, commercial cleanup contractors in addition to our own equipment to address the spill.

Mr. BREAUX. What can you tell the committee about the efforts by operators, by industry, I guess, with regard to having equipment and the plan in place to address a potential spill?

Captain CORBETT. I can address that question for the Georges Bank because that has been getting most of my attention recently as far as that is concerned.

The operators have placed on retainer, as we understand, it a group which is to develop their contingency plan and to develop the wherewithal, identify the equipment, Mr. Chairman, to respond to an oilspill on the Georges Bank utilizing the criteria which we have established and which I described in my testimony. As of yesterday, we have not received such a contingency plan. It is my personal view that it is within the wherewithal of that organization to develop it yet we still have not received it. I do not know why. If there are any doubts in anyone's mind that we intend to give it a very close look just because we receive it late—if it is delivered late we are not going to rush through it for that reason, we are going to give it our most deliberate attention.

Mr. BREAUX. What about in areas other than Georges Bank, where we have had leasing for years? What about the most recent period of time, does industry have contingency plans in place, with equipment and manpower?

Captain CORBETT. The OCS orders themselves require the contingency plan, the equipment, personnel, training, that sort of thing. Quite frankly in other areas the Coast Guard and Department of the Interior have not gotten as close together as we have on the Georges Bank situation. However, we do have regional response teams; the Coast Guard chairs those teams in the coastal regions and Interior is a member of those teams. But we have not had agreement with Interior where we would very specifically review those contingency plans although they are required, and I am sure Interior has reviewed them.

Mr. BREAUX. Thank you, Mr. Chairman.

Mr. STUDDS. Mr. Carney.

Mr. CARNEY. Thank you, Mr. Chairman. I was just concerned about the utilization of dispersants. I know that is probably not your responsibility to make that determination, but I was wondering do you have available studies on the use of it as opposed to containing the spills?

Captain CORBETT. We do have quite a large responsibility as far as the necessary studies the Environmental Protection Agency has the responsibility for studying the dispersant issue and has done so for a number of years. It has approved a number of dispersants. May I explain Annex 10 briefly of the National Contingency Plan. The predesignated on-scene coordinator has the authorization to use dispersants if he feels that there is a significant threat to life or property of say a gasoline spill, a light oil spill. He has the

authority to go ahead and move in on that right away. Outside of that the authorization is required of the regional response team member from the Environmental Protection Agency after he has consulted with the appropriate State. Then only if an important species is endangered or if the overall impact of the spill will be reduced by the use of dispersants. I might say historically in this country the use of dispersants has been quite conservative. I think that has been good. I think that as dispersants are becoming less toxic, and they are, our attitude toward them is changing somewhat. I think this is a good change. I do not think it is going to change quickly however. But we are looking at things such as the pre-identification of certain areas in certain times of the years at certain temperatures where an on-scene coordinator might use dispersants without referral to the RRT. One of the most important things about them is they must be used quickly, while the oil is fresh, before it emulsifies. So these decisions have to be made quickly because if you do not make them quicky you are out there applying dispersants not very effectively. So we are looking at ways we can make these decisions more quickly and effectively.

Mr. CARNEY. I have to admire you Captain, you answered about four of the questions I was going to ask in that one answer. One thing, would I be correct in summarizing what you have said by saying that the Coast Guard is continually making new SOP's as to the use of dispersants as more information is available to them and as the art and scientific reports as to their adverse effects are available to you?

Captain CORBETT. That is generally right, except it would be more accurate to say the regional response team, and the Coast Guard and EPA are on those teams, cochair those teams, are making those efforts, rather than the Coast Guard. EPA really has the overall responsibility for the policy on the issue of dispersants.

Mr. CARNEY. Thank you.

Mr. STUDDS. Mr. Hughes.

Mr. HUGHES. Thank you, Mr. Chairman. Thank you, Captain, for your testimony. I am a little concerned over your statement in response to earlier questions that you have not been as close, the Coast Guard has not been as close in following contingency plans in other areas of the OCS other than Georges Bank. What is the state of the siting or prepositioning of equipment and of contingency plans generally in the Baltimore Canyon area?

Captain CORBETT. I do not know. I would be glad to respond to that for the record if you like. It is no doubt in the contingency plan which the industry has submitted to Interior. We can obtain it from Interior and provide it to you.

Mr. HUGHES. I would appreciate your furnishing it. It gives me great concern. Here we are, we have sunk about, I guess, between 13 and 15 test wells in the Baltimore Canyon. Exxon just recently announced they are going to sink another delimiting well in the Baltimore Canyon. It would appear from your testimony that we have not paid too much attention to contingency plans in that area. That gives me great concern in view of the fact it would appear likely that we are going to find commercially extractable quantities of at least natural gas in that region of the OCS.

Captain CORBETT. Let me just say that we intend to extend this memorandum of understanding with Interior to other areas of the OCS, including the Baltimore Canyon. That is no excuse for not having done it in the first place, I do not mean to imply it is. There are a number of cleanup activities around the Philadelphia area. They are quite capable in that vicinity, I know that. But where they are located I really could not tell you.

Mr. HUGHES. Why would the Coast Guard be focusing attention on Georges Bank where OCS exploration is just underway and not be focusing attention on those areas that have seen quite a bit of OCS activity?

Captain CORBETT. I will be very direct, Mr. Hughes, the squeaking wheel syndrome really applies here. They are getting the oil right now and they have the Georges Bank which is a vast fishing ground.

Mr. HUGHES. I recognize the chairman of this committee is from the Georges Bank area and I am sure he has not been doing any squeaking. Let me just move on to something else. If you will respond to my concern in writing I would appreciate it.

You indicate in your testimony that by the fall of 1981, 26 systems, I assume you are talking about pumping and other systems, will be prepositioned around the country, that is, will be in place. How many systems exist presently.

Captain CORBETT. We have 13 of the skimmers, but we only have 4 of those fully equipped with the pumping arrays. It does not mean they cannot be used in concert with some of the other equipment, both we and industry have the wherewithal to remove the oil once it is collected. But these pumping arrays were adjusted as far as their physical makeup because of some of the things we learned at the IXTOC spill. We are moving right along on getting that equipment. Not only will it be available by the fall of 1981, they are going to be coming in in bits and pieces. So our capability will start to improve soon.

Mr. HUGHES. So you have four complete systems, is that what you are saying?

Captain CORBETT. Right.

Mr. HUGHES. How rapidly are we bringing on line new systems?

Captain CORBETT. The barriers are coming along at the rate of about one every 2 weeks right now. The pumping arrays are going to be a little bit slower because of some of these adjustments we found necessary to make resulting from our experience at Campeche.

Mr. HUGHES. Are these systems owned by the Coast Guard?

Captain CORBETT. Yes; they are.

Mr. HUGHES. You indicate there are ultimately to be 11 sites that will have equipment prepositioned. How many sites presently have any prepositioned equipment?

Captain CORBETT. Three, at our strike teams in Hamilton Air Force Base and Bay St. Louis, Miss. and Elizabeth City N.C.

Mr. HUGHES. What if anything is located at the prospective Philadelphia site or is that just a site in name at the present time?

Captain CORBETT. Well, it is a site in name only except that Philadelphia, you know, has historically had a lot of pollution-

related incidents. Industry is quite active there. I cannot be specific.

Mr. HUGHES. Much of that is not related to spills.

Captain CORBETT.The Member Information Network The industry is quite active there. We really have felt like the cleanup industry in Philadelphia has been adequate to the cleanup of spills in that area. But that is not to say that they are adequate to the OCS.

Mr. HUGHES. You indicate and the President has indicated by Executive order that he wants a 6-hour response time to a 100,000-ton spill. What is our present capability? If we had a spill in the Baltimore Canyon, how long would it take the Coast Guard to respond?

Captain CORBETT. How long would it take to deliver this kind of equipment we are talking about?

Mr. HUGHES. From wherever you have to bring the equipment from, like Elizabeth City.

Captain CORBETT. The same answer I gave to Mr. Pritchard earlier. To get it to the Philadelphia, or the nearest airport, Cape May, whatever, providing our airplanes can fly in the kind of weather which is occurring, very quickly, 4 to 6 hours. I do not see any problem there at all. The equipment is on pallets on trailers, put it in an airplane and off it goes. But it is when they reach that site, there is the problem. There is the problem of weather. I think in the Baltimore Canyon, if the weather was good, because the drilling activity is occurring and there are support vessels of the drilling industry's types in the vicinity, getting it out probably would not be a serious problem. But if the weather is above 10, 12 feet it is not going to get out there, that is all there is to it. But to get it to the general area, we can move very quickly. I am quite confident of that.

Mr. HUGHES. Is there any OCS activity at all in the immediate vicinity of Elizabeth, N.C.?

Captain CORBETT. I do not believe so, but I would defer to Interior on that. I am not aware of any.

Mr. HUGHES. Why is the equipment prepositioned at Elizabeth City when most of the OCS activity is taking place north of that area?

Captain CORBETT. When the Coast Guard——

Mr. HUGHES. In Baltimore Canyon.

Captain CORBETT. When the Coast Guard first became involved with oil spill response, our philosophy was and I think it was correct at that time—we did not have a lot of equipment, people all over the country, at least who could respond to big oil spills. So the philosophy was to locate the equipment and the people at locations around the country and respond by aircraft. Since that time our philosophy has changed somewhat. OCS drilling activity is occurring. Transportation corridors have perhaps changed. We now feel like it is a more sensible idea to stage the equipment around the country than to place them at the three locations we now have.

Mr. HUGHES. Have you looked at possibly relocating some of that equipment that you have now to places where they have activity?

Captain CORBETT. No; the 26 barriers and complete systems about which I am talking—I say with some confidence we have it about

in our hands, it is fully budgeted and we expect to get it. That equipment will go to these places.

Mr. HUGHES. I would hope equipment is located in those areas that are experiencing accelerated activity.

Captain CORBETT. This is why these 11 sites have been identified, because of the activities which they are experiencing, not necessarily, however, OCS activity, because again we intend to insure at least starting with the George's Bank, following on with the Baltimore Canyon and others, that the industry has the equipment themselves to clean up their oil spill.

Mr. HUGHES. You have it just reversed, the Baltimore Canyon is well under way, we have been exploring in the Baltimore Canyon for the better part of 3 years. We are now sinking delimiting wells. We should not wait until we begin producing before we develop the capability of responding as quickly as possible to a spill. As I understand it, the spills occur usually do not occur during the exploration process but during production and other processes. Exploration as I understand it is a relatively safe, low risk, operation generally.

Captain CORBETT. I fully understand your point, Mr. Hughes. I suspect that the Department of Interior has been quite thorough in review of the plans submitted to it by the drilling operators in the Baltimore Canyon. But we, the Coast Guard, have not yet become involved in the review of those plans. That is a fact.

Mr. HUGHES. I am also concerned about your testimony that we seem to be at the outer limits, which is entirely conceivable, in that our present capability or, state of the art is 8- to 10-foot seas and 20-knot winds. Each year for the last several years this committee has increased the authorization for research and development by about $25 million. The same thing RAS occured for fiscal year 1981. Do you know offhand how much of the research and development money in the fiscal year 1980 budget has been spent by the Coast Guard?

Captain CORBETT. No, sir, I do not.

Mr. HUGHES. Would you get that information for me?

Captain CORBETT. Yes; I can.

Mr. HUGHES. Would you also provide for the committee the type of projects that are underway in R. & D. Projects that you think will be funded for fiscal year 1981, so we know how much really is being spent on R. & D. and on what.

Captain CORBETT. Are you talking about pollution response now?

Mr. HUGHES. Yes.

Captain CORBETT. Yes, sir, I would.

Mr. HUGHES. Thank you very much. In spite of my questions I think the Coast Guard does an absolutely great job, not just in this area of responsibility, but also with other functions such as air and sea rescue, aids to navigation, tanker safety, and in so many other areas that affect us along the coast. Thank you very much.

Mr. STUDDS. They do a particularly good job in responding to your questions. Did it occur to anyone that exploratory drilling is so safe because 9 out of 10 of those holes are dry. Mr. Wyatt.

Mr. WYATT. Thank you, Mr. Chairman. Captain Corbett, how many oilspills have there been in the last year?

Captain CORBETT. Talking about spills of the——

Mr. WYATT. On the OCS.

Captain CORBETT. On the OCS. Well as far as OCS activities, I do not recall any that are of a serious magnitude. We have had some shipping accidents. The Mexican blowout which I assume you are excluding.

Mr. WYATT. Let us start with Campeche, after that how many times has the Coast Guard responded to a spill on the OCS, due to drilling wells completed or blowing out?

Captain CORBETT. I do not recall any at all except just a few days ago, Texaco-North Dakota did hit an inactive rig in the gulf but did not result in a spill of any magnitude. So to the best of my knowledge it is none.

Mr. WYATT. You have not been called upon in the last year since Campeche to respond to a spill?

Captain CORBETT. Not resulting from OCS activites, right.

Mr. WYATT. Before that, would you tell me how many times you have been called upon to respond to a spill before Campeche?

Captain CORBETT. Well, I, myself, none. There have been some. I would be glad to give you a list of those say over the last 3 or 4 years if you like. There have been some. There have been some rigs which were damaged either through blowouts or whatever. Most of the activity took place as a result of the people problem, rescuing the people. I do know of one spill several years ago, quite a large magnitude, but I was not personally involved and do not even recall the name of it.

Mr. WYATT. Where was that?

Captain CORBETT. That was in the gulf.

Mr. WYATT. How many years ago?

Captain CORBETT. Well, I do not know, but I remember some of the incidents or some of the words revolving around the reports but I cannot be specific at all. Then there was Santa Barbara on the west coast, way back in 1969.

Mr. WYATT. In your memory there have been two?

Captain CORBETT. That is right, two major ones. I am sure that there are a number of small spills that occur from daily operating procedures at the activities. I would not want to be held down to two. Let me put it this way if you want to try to get it in perspective. When you compare it with shipping accidents, when I think of an oilspill I think of ships or large dischargers from large facilities ashore. Generally speaking, I think that the oil industry has done a very good job of protecting us from damage to the environment from oilspills.

Mr. WYATT. The Coast Guard does not do—you do not do a study of the damage done, that is not your responsibility, is that correct?

Captain CORBETT. That is correct, yes.

Mr. WYATT. Whose responsibility is that?

Captain CORBETT. In the OCS or in the coastal areas of the country, NOAA has that responsibility; EPA in the inland regions.

Mr. WYATT. NOAA has responsibilities in the Outer Continental Shelf, bays and estuaries?

Captain CORBETT. Yes, sir.

Mr. WYATT. EPA has it in the inland areas?

Captain CORBETT. Yes.

Mr. WYATT. You said earlier and I did not quite understand that you were having some difficulty in working with Interior, maybe difficulty would not be the correct word.

Captain CORBETT. That is not correct. Maybe you would rephrase it. I did not say that at all. I said that in the earlier OCS activity the Coast Guard did not become involved in review of the contingency plans. Whose fault that is might be in part the Coast Guard's fault for all I know. But as we started to see the activity on Georges Bank and the intense environmental concern, then we did become more involved with Interior and are assisting them in their review of the contingency plans. That will be extended to other areas as well.

Mr. WYATT. Is there some geological structure of Georges Bank that is different from that in the Gulf of Mexico or Baltimore Canyon that creates the environmental concern there? Is there a higher susceptability to blowout; is there as I said a unique geological structure in the Georges Bank? You know, we in Texas oftentimes—I think, fish very near to oil wells. If we can find a well, we go there and fish. So does everyone else. I think the same thing is true in Louisiana. Is there a big difference between up there and in the gulf?

Captain CORBETT. I have not the slightest idea Mr. Wyatt. But there is a difference in the attitude I think of the people around Texas and Louisiana. Oil has been king for a long time as you well know. Coming from Oklahoma, I came from that part of the country myself. But it is not so up around the Northeastern part of the country, perhaps.

Mr. WYATT. Thank you. Thank you, Mr. Chairman.

Mr. STUDDS. I am going to answer your question myself. Mr. Hughes pointed out that traditional treatment for squeaky wheels, lubrication with oil. With regard to the dramatic revision downward of the goal in terms of cleanup capability——

Captain CORBETT. Would you repeat that.

Mr. STUDDS. With regard to the dramatic downward revison of the Nation's goal in terms of cleanup capability, in the March 1977 letter the President stated the "goal is an ability to respond within 6 hours to a spill of 100,000 tons;" 3 years later the Commandant of the Coast Guard says that our objective is a nationwide aggregate oil recovery capacity of 200 tons of oil per hour, conditions permitting. I cannot even calculate what percentage that is, but it is not much, compared to what the President said 3 years ago. Instead of 100,000 tons within 6 hours it is now an aggregate nationwide capacity of 200 tons per hour, conditions permitting. What happened?

Captain CORBETT. What happened is that we are having to compete with resources of the government, and we looked at it very carefully. We determined that we could respond with nearly the same capability by reducing the numbers of locations by only a few and reducing the number of men from nearly 330-some to 20-some, and provide only slightly less, what in our view is only slightly less response capability. If you like, I would respond to that question more fully in writing.

Mr. STUDDS. I would. Because I do not think the reduction from 100,000 to 200 is slight. Do you?

Captain CORBETT. We are not sure that one is not a rate and one is a total spill size.

Mr. STUDDS. I see. OK. Let us get that because on the face of it, it appears to be dramatic.

Captain CORBETT. I would like to respond to it in writing.

Mr. STUDDS. OK. I think the record in general will be held open for questions. You have talked in response to questions of other members about the mandate for the prepositioning of cleanup equipment in regions of OCS activity around the country. That is equipment which the Coast Guard will require to be prepositioned; is that correct?

Captain CORBETT. That is correct, purchased and owned by the operators or their agents.

Mr. STUDDS. Now is that a prior condition or one of many prior conditions, for example, for a final permit for exploratory drilling?

Captain CORBETT. That is the intent. Interior grants the final permit, not the Coast Guard. But the intent is exactly that, that before the permit is granted, the equipment will be in place, the contingency plans approved, as approved by the Coast Guard, or I should say as recommended to Interior by the Coast Guard. So Interior has the final authority to grant the permit. But we are hoping and feel that Interior will rely heavily on the Coast Guard's expertise in this field.

Mr. STUDDS. But Interior under the law has the authority to go ahead with or without the approval of the Coast Guard; is that correct?

Captain CORBETT. Under the law, yes, sir.

Mr. STUDDS. Has that ever happened, have your recommendations been ignored by Interior yet?

Captain CORBETT. No, sir.

Mr. STUDDS. You have no reason to think they would be, I assume?

Captain CORBETT. No, sir.

Mr. STUDDS. With respect to the prepositioning requirements, they would be in any OCS region, generally defined the mid-Atlantic, Georges Bank, Gulf of Alaska, rather than for any particular company's lease?

Captain CORBETT. Probably. It depends on the situation. For instance, on lease sale 42 it is by lease. As long as the 6-hour response capability is met, then it does not matter to us where they are sited. The equipment could be sited on the rigs themselves or on some of the vessels which support the rigs nearby ashore, or perhaps on some of the even fairly distant, I would not say remote, as long as they can demonstrate to our review process they can be there within 6 hours, then that is considered adequate.

Mr. STUDDS. Have you had such plans submitted with respect to lease sale 42?

Captain CORBETT. No, sir, but we are hoping it will be fairly soon. We are watching that very closely as a matter of fact. But the plan itself has not yet been submitted to us.

Mr. STUDDS. Now the 11 sites of which only three are equipped at the moment around the country, these are Coast Guard sites as opposed to industry sites?

Captain CORBETT. That is right.

Mr. STUDDS. What is the timetable at the moment for the deployment of the remaining eight sites?

Captain CORBETT. Over a 3-year period, 1984 is the last year in which the sites will be fully operational. We will have some equipment at each one of the sites as time goes by, but it will take about 3 years to get the thing fully in place.

Mr. STUDDS. No wonder Presidents are frustrated. Even if this President—without comment—were to be reelected, a directive which he issued in the first year of his first term will not be completely fulfilled in the year in which he leaves office at the end of his second term, that is incredible. Maybe you are not prepared to answer this, but has the Congress been stingy, or OMB, or what happened? When a President gives a directive—announces with great fanfare to the Nation that we are going to have eight sites, how come we now say that maybe 7 or 8 years after that directive we can get to the eight sites. It is not a very big item in terms of overall dollars.

Captain CORBETT. You are right, I would not be prepared to respond to that.

Mr. STUDDS. Yes. That is an awkward fall for all of us, is it not?

Am I correct in my understanding that Clean Atlantic Associates, which is an industry group, has already positioned cleanup equipment in Davisville, R.I.?

Captain CORBETT. I understand that, but I do not have that on good authority.

Mr. STUDDS. That has not been reported to you yet?

Captain CORBETT. Frankly it would not be reported to me, it would be reported to our predesignated on-scene coordinator in Boston. He will make these decisions.

Mr. STUDDS. Admiral Hayes in testimony earlier this year before the Coast Guard Subcommittee of this committee, Chairman Biaggi pointed out:

> The most significant reduction in any particular category of the Coast Guard's fiscal 1981 budget request was made at the OST level. In the operating expense category of maritime environmental protection in the amount of $23 million. What does this significant budget reduction represent? Will it hamper the Coast Guard's ability to adequately respond to spills of oil or hazardous substances?

Admiral Hayes' answer was—

> It will not permit us significantly to improve our ability to respond to oil spills. It will also require that we redirect our efforts away from other areas of marine environmental protection when necessary to cope with the increasing demand created by hazardous chemical emergencies, particularly abandoned hazardous waste sites.

Has it indeed been necessary to redirect efforts and resources away from the areas we have been talking about?

Captain CORBETT. I think in the area of hazardous wastes and chemicals as Admiral Hayes pointed out we would like to be able to train ourselves better to more adequately respond to those incidents I would agree.

Mr. STUDDS. But my question was, In order to do that, have we had to redirect efforts and resources away from the kinds of problems we have been talking about this morning?

Captain CORBETT. Not significantly, but to some level, yes.

Mr. STUDDS. How significantly?

Captain CORBETT. There I would ask to respond in writing. We are talking about dollars and cents now.

Mr. STUDDS. All right. Mr. Pritchard.

Mr. PRITCHARD. No more questions.

Mr. STUDDS. Thank you Captain. I do not know whether you want to add generalization in response to my opening generalization. I have to commend you for being as straight forward and explicit and frank in its caviats about the modesty of our capability. I think that is to the good. We need to know. No problem is going to be solved by pretending it does not exist or less severe than in fact it is. Mr. Wyatt is gone, but it is obvious what he was trying to get you to say. Even if you are from Oklahoma, I appreciate the calmness of your response. He did not ask you prior to the incident in Chicago when the last DC-10 crash was. These are the kinds of things that mandate prudent people to proceed with extreme caution sometimes, given the magnitude of the resources at risk. Is there anything else you would like to add? I appreciate your own patience, and testimony in putting up with all the members of this committee including me.

Captain CORBETT. No, sir. Only I have known Mr. Wyatt for sometime and I am sorry I had to disappoint him.

Mr. STUDDS. You were at that hearing in Corpus Christi where his own fishermen were saying the most unkind things about the oil industry.

Captain CORBETT. I appreciate the opportunity to be here and I have enjoyed it. Thank you.

Mr. STUDDS. Thank you. Now we have the Environmental Protection Agency. R. Sarah Compton, Deputy Assistant Administrator, Office of Water Enforcement, Environmental Protection Agency.

## STATEMENT OF R. SARAH COMPTON, DEPUTY ASSISTANT ADMINISTRATOR, OFFICE OF WATER ENFORCEMENT, ENVIRONMENTAL PROTECTION AGENCY

Ms. COMPTON. Good morning.

Mr. STUDDS. Good morning.

Ms. COMPTON. Did you want to make another statement before I begin?

Mr. STUDDS. I will do my best to refrain from making any statements until you have completed your testimony. I notice you have about 11 pages, feel free if you wish to summarize it, however you want to proceed. In any event it will appear in its entirety in the record.

Ms. COMPTON. Thank you. I am pleased to be here today to discuss the authorities and responsibilities of the Environmental Protection Agency (EPA) to regulate effluent discharges associated with offshore oil and gas exploration and production on the Outer Continental Shelf (OCS). Dr. Suzanne Bolton, a marine biologist in our Ocean Programs Office is here with me today. As I will discuss in more detail later, EPA regulates these pollutants from OCS facilities pursuant to the Clean Water Act's national pollutant discharge elimination system (NPDES) permit program. This NPDES permit program is an important mechanism for insuring that the effluents associated with offshore oil and gas operations are discharged in an environmentally sound manner. However, just

as it is EPA's responsibility to independently determine appropriate environmental limitations, it is also EPA's responsibility to insure that NPDES permits for offshore oil and gas facilities are issued without unnecessary delays and in coordination with other Federal agencies having responsibilities on the OCS.

Thus, EPA is committed to an OCS permitting policy and process which: (1) insures that NPDES permit limitations are established which will provide adequate protection of the marine environment; (2) Develops necessary permit limitation at the earliest possible stage in the OCS lease sale process. I will describe that a little bit later. To the extent possible, we are moving to achieve this by gathering and evaluting our information in cooperation with other Federal agencies as part of the development of environmental impact statements prepared prior to the OCS lease sales; (3) Establishes in the rulemaking process appropriate permit limitations, such as new source performance standards and ocean discharge guidelines; and (4) Promotes the issuance of the less resource-intensive NPDES general permits and I will describe the general permit process later.

EPA's statutory authority to regulate discharges into marine waters from offshore oil and gas exploration and production operations is derived from the Outer Continental Shelf Lands Act, and its 1978 amendments, which you are familiar with, and from the Federal Water Pollution Control Act, now known as the Clean Water Act.

Section 402 of the Clean Water Act established the NPDES permit program to regulate the discharge of pollutants from point sources into waters of the United States including the territorial seas, continguous zone, and the oceans. Section 301 of the Clean Water Act prohibits the discharge of any pollutant without an NPDES permit or in violation of the terms and conditions of an NPDES permit.

The Clean Water Act authorizes EPA or, if a State NPDES permit program has been approved, an approved State to issue NPDES permits. However, EPA issues permits to all point sources, such as mobile drilling rigs and production platforms, discharging into the ocean waters beyond the 3 mile territorial limit, regardless of whether the adjoining coastal State has an approved NPDES permit program.

The Outer Continental Shelf Lands Act, Public Law 95-372, extends Federal laws such as the Clean Water Act, to the seabed, subsoil, and fixed structures, such as artificial island drilling rigs, located on the Outer Continental Shelf. Thus, NPDES permits are required for all discharge from offshore oil and gas facilities in OCS lease sale areas.

I would like to describe now our NPDES permit process. The NPDES permit process begins when the owner or operator of a pollution source files a standard application form for an NPDES permit. If sufficient information is not available to develop a draft permit, the State or EPA may request the applicant to submit additional information such as bioassay and bioaccumulation test data. Upon receipt of adequate information and after assessment of the guidelines applicability to this source and other matters, a draft permit is prepared and a public notice of the draft permit,

representing the intention to issue a permit, is published. Since the Clean Water Act (the act) requires EPA to provide for public participation in the permit process, the draft permit is made available for comment; the public comment period is specified in the public notice, and must be at least 30 days. If the permit is being issued by EPA, a State certification is requested to determine if the permit limitations are sufficent to meet State water quality standards for the receiving water that is involved. Also if there is sufficient public interest, a public hearing will be held on the draft permit.

After review of comments received on the draft permit, the permitting authority may issue or deny a final permit. If the terms of the final permit are significantly different than those originally proposed, then the final permit may be reproposed for public comment. After the final permit is issued, any interested party may contest its issuance or its terms within 30 days. As you know some of the flower garden permits which were just issued are being contested. If EPA issues the final permit the challenge is in the form of a request for an administrative evidentiary hearing.

The permit process is governed by our consolidated permit regulations (an effort to streamline all of EPA's permitting efforts which we hope works), and when EPA has approved a State NPDES program, is additionally governed by a memorandum of agreement with the State. EPA may object to the issuance of a permit by a State, if the permit does not reflect the guidelines and other requirements of the act. If the State fails to take timely remedial action, EPA may issue a permit of its own, though this has rarely occurred.

An important new aspect of EPA's regulatory reform effort is the provision which allows EPA or approved NPDES States to issue general permits to control the discharge of pollutants from numerous point sources located in the same geographic area if their discharges warrant similar pollution control measures. As I will discuss later, EPA issued 10 days ago its first three draft general permits covering over 2,000 offshore oil and gas facilities operating in the Gulf of Mexico. General permits can be issued without any application required from individual owners or operators. After deciding the geographic area to be covered by the general permit, the permitting authority develops a draft general permit which is subject to public notice, comment, and public hearing just as an individual permit.

All NPDES permits, both individual and general, contain interim and final effluent limitations, schedules of compliance to achieve final effluent limitations, self-monitoring and reporting requirements, and standard "boilerplate" language.

Under the Clean Water Act, EPA has established effluent limitations guidelines for a number of industrial categories. One such category is the offshore subcategory of the oil and gas extraction point source category. The offshore subcategory includes facilities engaged in the production, field exploration, drilling, well production, and well treatment within the oil and gas extraction industry which are located seaward of the inner boundary of the territorial seas. The guidelines for the offshores subcategory are technology-based and form the basis for effluent limitations contained in

NPDES permits, such as the daily maximum limitation of 72 mg/1 of oil and grease in discharges of produced water established by the effluent guidelines for the offshore subcategory.

Both exploration and production operations of the oil and gas extraction industry generate discharges subject to NPDES permit limitations. As you are familiar, these operations discharge drilling fluids, drill cuttings, produced waters, deck drainage, and sanitary and domestic wastes which are limited in part by the technology-based effluent limitations guidelines. As you may know, our primary concern on the OCS has been with drilling fluids (or muds) and drill cuttings which, depending upon the nature of the receiving waters, have been regulated differently through NPDES permits.

For the discharges I have just described, NPDES permits issued after July 1, 1977, contain interim effluent limitations based on the more stringent of effluent guidelines, representing best practicable control technology (BPT), or limitations necessary to meet the water quality standards of the receiving waters.

When finally promulgated for new sources, final effluent limitations will be based on new source performance standards. Until new source performance standards are promulgated in about 18 months, discharges of conventional pollutants, such as oil and grease, will be governed by best conventional pollutant control technology or BCT.

Most important for this hearing today, in addition to the technology based limitation I have just described, section 403 of the act may require more stringent permit limitations for discharges into the oceans. Congress paid special attention to discharges into the oceans and charged permit writers to make such complex determinations as the effects of pollutants on marine organisms, including ecosystem diversity, productivity, and stability, and esthetic, recreation, and economic values, as well as human health. Furthermore, these determinations are to be made prior to issuing an NPDES permit. Based on these determinations, limitations necessary to minimize or prevent significant degradation, that is language from the act, may be imposed in the NPDES permit issued to a marine discharger.

EPA will promulgate in the near future ocean discharge guidelines to aid permit writers in making these determinations. Until that time, section 403(a) provides that a permit may be issued for a marine discharge if it is in the public interest to do so.

Our interim policy for implementing section 403(c) provides that the criteria set forth in that section which I alluded to above are to be considered and applied in the issuance, reissuance or review of all NPDES permits for ocean dischargers. In addition, the ocean dumping criteria are to be applied to the fullest extent possible where appropriate.

As you may be familiar, the primary aspect of the ocean dumping criteria that concerns us for the ocean discharge area is compliance with the "Limiting Permissible Concentration" (LPC). The LPC means discharge of that concentration of a pollutant which will not cause unreasonable acute or chronic toxicity or cause sublethal adverse effects on marine organisms. The scientific tests to determine an LPC for specific pollutants are laboratory tests conducted with appropriate sensitive marine organisms.

Now that you have an idea of our NPDES permitting process, I would like to describe briefly our OCS permitting policy. Because of the complexities involved in assessing the potential for significant harm of the marine environment, EPA has a number of actions underway to insure that effluent discharges associated with the development of offshore oil and gas resources are managed in an environmentally sound manner. At the same time, these actions are intended to expedite the issuance of NPDES permits to offshore oil and gas facilities and to avoid costly startup delays for facilities which would cause no adverse environmental impact.

I know you heard a great deal about Government committees and may be skeptical about the virtue of yet another one, but the agency has created a much needed Outer Continental Shelf Coordination Committee to coordinate agency efforts in this area. It is not mentioned in the written text but as you may know there are about five or six offices within EPA who have some role in deciding what our policy should be with regard to OCS. We have decided to combine those offices in part into a committee, which I chair, to have one unified policy from the agency. Two important functions of the committee are the development of a memorandum of understanding to coordinate our research activities with the Bureau of Land Management, U.S. Geological Survey, and the U.S. Coast Guard, and the coordination of research activities by a drilling muds and formation waters task force. That task force is solely within EPA.

The focus of the memorandum of understanding is to increase EPA's participation in the OCS lease sale process during the development of environmental impact statements (EIS) in order to assess the vulnerability of specific lease areas to the discharges associated with offshore oil and gas operations. If we can assess vulnerability at this early stage, we can determine appropriate NPDES permit conditions and avoid delays in issuing NPDES permits. Inspection and compliance sampling requirements of each Federal agency will also be coordinated in the memorandum of understanding.

The efforts of the Drilling Muds and Formation Waters Task Force will include the identification of gaps in current knowledge and research concerning the environmental fates and effects of drilling muds and formation waters.

To further coordinate EPA's activities on the OCS with other Federal agencies, State and local governments, EPA is also participating in the Biological Task Forces for the Flower Gardens, Georges Bank, and Beaufort Sea. Both the Flower Gardens and Georges Bank Task Forces have now completed draft research and monitoring plans.

Finally, I would like to acquaint you with the Agency's most recent efforts to issue NPDES permits for offshore oil and gas facilities. For the record, I have submitted a chart which summarizes the status of NPDES permits issued for offshore oil and gas facilities. The largest number of offshore oil and gas dischargers is located in the Gulf of Mexico. There are approximately 2,000 facilities in the offshore subcategory currently operating in the Gulf. EPA's Region VI office in Dallas recently published a public notice of three draft general NPDES permits which when finally issued

will regulate discharges from the majority of these facilities. Productive or unique biological areas, not covered by these general permits, will receive further evaluation, and may be the subject of future general permits. Different areas of the OCS may require different permitting strategies and different permit conditions.

You may be familiar with the Flower Gardens in the Gulf of Mexico. To date, three final NPDES permits have been issued and nine additional draft NPDES permits have been proposed. The permits establish no discharge zones for both drilling fluids and cuttings to protect this sensitive marine ecosystem. I want to comment that the no discharge zones for the drilling fluids is greater than the area for the cuttings. EPA's most recent NPDES permitting action concerns the Georges Bank. Our region I office in Boston is currently reviewing NPDES permit applications submitted by four companies for exploratory drilling in Georges Bank. As part of the application requirements, EPA required the applicants to submit bioassay and bioaccumulation test data for the drilling muds that they expect to use in this area. Appropriate NPDES permit limitations and monitoring requirements will be developed once these data are received and evaluated, along with the recommendations of the Georges Bank Biological Task Force. We have been working with the companies, other Federal agencies, and environmental groups and expect to publish the notice of draft NPDES permits for Georges Bank by December.

In the next few years, EPA expects to continue efforts to issue NPDES permits in a timely manner through increased participation in the OCS lease sale process, through efforts to increase the collection of scientific data on the fate and effects of the discharges from oil and gas facilities, and through coordination of NPDES permitting with the OCS lease sale process.

Thank you for this opportunity to highlight our OCS permitting activities. I will be happy to answer questions concerning these activities.

Mr. STUDDS. Thank you very much, Ms. Compton. I have a number of questions but I think they all boil down to one in terms of importance. I am going to ask you the big one first, what I think is the most important one. And that gets at, I will get more specific in a moment, how your agency, given the way the law under which you operate reads, could be granting any permits or could have to this date granted any permits, for the discharge of drill muds into the ocean. Let me begin by quoting as you I am sure know by heart and I think you cited in your testimony, from section 403 which sets the criteria for ocean discharge permits. The last sentence of which, section 2, says: "In any event where insufficient information exists on any proposed discharge to make a reasonable judgment on any of the guidelines established pursuant to this subsection no permit shall be issued under section 402 of this Act." I read that as an absolute outright prohibition on the issuance of a permit in the absence of sufficient information to assess the criteria which you are directed to assess and to follow in that section. EPA provided testimony before this committee earlier this year on this very subject when as you know we had scientists representing Interior, Commerce and EPA, one of whom was Dr. Bolton sitting at your right. Almost without exception they told us we do not know all

the components in drill muds, we are not aware of all of their chemical composition because to a certain extent that is proprietory data held in confidence by the industry. Inasmuch as we have studies done they do not answer questions on either short- or long-range effects with regard to the possible toxicity of the content of these materials. Let me quote for you. In those hearings I asked this question of the scientists. I said:

In summary, if each of you were asked the general question, given the state of our knowledge at this time, as you understand it, of the effects both short term and long term on the marine environment of drill fluids, can you as scientists tell me the effects are such to cause serious concern—or do our studies indicate that while there may be some effects, they are not of sufficient magnitude to give us pause as we proceed?

Mr. HIGHT. At this time, we do not have the information that shows really that they are that harmful.

Mr. STUDDS. We do not have the information that they are harmful?

Mr. HIGHT. Yes.

Mr. STUDDS. Do we have the information that shows that they are not harmful?

Mr. HIGHT. We do, I think.

Mr. STUDDS. Mr. Burke?

Mr. BURKE. From what we know now, just right now, there are effects of discharge of drilling fluids. They are short term. They are localized. I do not know whether it is a cause for concern. I do not know whether the long-term implications of these materials being introduced into the environment are a matter for concern.

Mr. STUDDS. That was the Bureau of Land Management. Dr. Richards from the EPA said in response to that question, "We have inadequate information for making a hazard assessment. The inadequacy lies in the lack of understanding of the exposure of animals, particularly in these specific niches that I mentioned like the benthic communities."

Dr. Bolton said, "I would be very hesitant with the current state of knowledge to make any endorsement of general discharge of drilling muds, particularly in sensitive areas of the Outer Continental Shelf."

Three of its scientists, three different agencies, saying we simply do not know. Let me quote to you from Research Highlights, 1979 from your own agency study done last year by the EPA on this very subject in the Gulf of Mexico. I am reading from your own publication which I gather is a summary of the research of the agency last year. It says:

The research findings in this project and from the various scientific literature show that drilling fluid is ten times more toxic than industrial effluents such as untreated wastes from oil refineries or pulp mills. Carcinogens are discharged during drilling operations. Drilling compounds thought to be insoluable and therefore biologically unavailable are, instead, activitely taken up by marine organisms. Chemicals normally discharged are capable of accumulating in marine organisms. Chemicals discharged persist for years in sea bottom sediments. A wide variety of organisms that normally live on the sea floor cannot grow on sediments contaminated by drilling fluids. Effects of chemicals on coral may be delayed for a year before they can be observed.

I still quote from EPA's own publication:

These findings do not answer all the environmental questions about the effects of oil and gas drilling. The effects of different chemical mixtures on different marine species still need to be determined to fulfill the data needs of future discharge permits.

That is from the Environmental Protection Agency. Once again let me read you the law. "In any event where insufficient information exists on any proposed discharge to make a reasonable judg-

ment on any of the guidelines established pursuant to this subsection, no permit should be issued under section 402 of this act." Under those circumstances, never mind the future, how could EPA have issued permits in the past?

Ms. COMPTON. Well, I think that is a very good question. And at times a very difficult question to respond to. As I mention in my testimony with regard to the Flower Gardens that while we found the area to be of unique and sensitive biological concern, we made the reasonable judgment that the permit should issue in the public interest but that there would be no discharge of cuttings and drilling muds within a certain area of the Flower Gardens, in order to protect that area until we could undertake more research.

With regard to the three general permits that we just proposed in the Gulf of Mexico, covering approximately 2,000 rigs, we concluded and made a reasonable judgment that because these areas covered by this general permit do not cover any live bottom areas or any hard bank areas or any other areas that we consider of biological concern or significant biological concern, that there would be no adverse impact based on the criteria listed in 403, in that area. We intend to make a similar assessment with regard to Georges Bank. We have asked that the applicant submit to us bioassay, bioaccumulation data on the 8 to 10 classes of muds that they intend to use in the Georges Bank and we will take a look at that information and see what the impacts would be on the Georges Bank organisms and together with other data that we have, decide whether we should require either the barging of the drilling muds or cuttings or meeting a limiting permissible concentration, in other words, a slow discharge of it, or normal discharge of the muds and cuttings.

Mr. STUDDS. My question to you really is how can anyone in that agency make such a determination and state that it is reasonable when your own scientists tell you that you do not know what you are talking about?

Ms. COMPTON. Well, our own scientists have advised us that we need to know a great deal more about drilling muds and cuttings.

Mr. STUDDS. Right. The law says when you do not know, you do not permit. It does not say anything about reasonable or unreasonable. It says when the knowledge is insufficient you do not permit.

Ms. COMPTON. It says—excuse me. It says if there is insufficient information to make a reasonable judgment.

Mr. STUDDS. Right.

Ms. COMPTON. With regard to the general permits in the Gulf of Mexico which we just issued, we believe that because no areas of biological concern were involved in those areas that we could make a reasonable judgment that there would be no adverse impact on the environment or no significant impact.

Mr. STUDDS. I am sure Mr. Breaux will leap to the defense of the environment of the Gulf of Mexico and its fishing industry. My knowledge of the gulf's particular regions is not great enough to question you closely as to whether or not there are significant commercial fishery resources in that area. You are about to be asked to make a judgment. You have application permits pending in Georges Bank?

Ms. COMPTON. That is right.

Mr. STUDDS. As I understand it from not only your own scientists but those of other agencies, there is no way in this world that we have existing studies adequate to make a reasonable judgment of these questions in an area of the extraordinary biological delicacy of the bank. Under those circumstances how could you even consider such permit applications?

Ms. COMPTON. As I mentioned earlier we are waiting for the data that is to be supplied to us by the applicants with regard to the classes of fluids that they intend to use in the Georges Bank area and when we receive that data we are hopeful that we will be able to make a reasonable judgment as to whether those muds can be discharged.

Mr. STUDDS. How can you make a reasonable judgment when your scientists have testified that no studies have been done upon which such a judgment could be based? We do not have the information. We have no idea what the long-term effects are, and very little idea, testimony indicates, what the short-term effects are.

Ms. COMPTON. Our conclusion—I do not know what the bioassay and bioaccumulation data will tell us. The data may indicate that we should not allow any discharge of those muds and cuttings. The data from——

Mr. STUDDS. The data from the oil industry?

Ms. COMPTON. Yes. It may indicate that there are chronic and toxic effects and therefore there should be——

Mr. STUDDS. You do not believe any more than I do, do you, that the oil industry is going to come in and tell you there are toxic effects from what they propose to discharge? You are going to rely on whether they tell you that or not.

Ms. COMPTON. That is not the sole information on which we will rely in issuing these permits.

Dr. BOLTON. We also have a research program ongoing in the New England area.

Mr. STUDDS. I just read from your agency's own publication on the subject which raises more questions. It does not make one feel better about the situation.

Ms. BOLTON. That is true, but I believe there has been a significant amount of information gathered in recent months that at least gives us a little bit more to go on. A draft study from the New England Aquarium gives us more information about toxicities. In fact one of the least toxic of the muds used in these studies was one from the Baltimore Canyon, about which I believe Mr. Hughes was asking.

Mr. STUDDS. This speaks to the question of short-term toxicity but presumably does not speak to the question of long-range toxicity or long-range sublethal effects in behavioral changes.

Dr. BOLTON. It is purely a prerequisite test in a spectrum of toxicity testing.

Mr. STUDDS. Purely the request. Toxicities.

Dr. BOLTON. In a particular location.

Mr. STUDDS. The kinds of concerns of effect over time of the environment, one of which was raised by your own study.

Dr. BOLTON. This is something we are still trying to address.

Mr. STUDDS. And presumably will not have addressed within the next few months when decisions will have to be made?

Dr. BOLTON. We will have some of that information then, yes, on the scallops and also some of the flounder of Georges Bank.

Mr. STUDDS. Over what period of time?

Dr. BOLTON. I believe they have completed a 2-month study.

Mr. STUDDS. That is not long term.

Dr. BOLTON. You extrapolate from those results, yes. To run longer term studies is often economically unfeasible, with the funding we have for research.

Mr. STUDDS. I did not ask you that. Let me just say, you state we have to extrapolate on the basis of 3 months data. The EPA study with respect to coral says you may not be able to see effects for a year. So if you extrapolate on the basis of 3 months that would not be very productive.

Dr. BOLTON. Fortunately, hard coral is not one of the problems with which we are dealing in Georges Bank.

Mr. STUDDS. We hope.

Dr. BOLTON. We hope.

Mr. STUDDS. Unless we find something a year later we did not see, right?

Dr. BOLTON. I think we know that there are not hard corals.

Mr. STUDDS. We know they are not corals, we think we know that.

Dr. BOLTON. To extrapolate from the discussion of hard corals to Georges Bank benthos would be stretching it.

Mr. STUDDS. We may be overextrapolating.

Dr. BOLTON. Yes.

Mr. STUDDS. My concern I think is obvious. I think the law is unusually clear. That prohibition is not obfuscated or couched with too many conditions. It appears to me to be pretty much of an outright prohibition in the case of insufficient knowledge. If our scientific testimony has anything in common, even from agencies which tend to be more innately benign with respect to the industry, it is that we do not know effects, we simply do not know. We do not even know in some cases, as I understand it, what it is that we are permitting the discharge of, never mind what its effects might be. I really do believe, and I realize this is a question that it is not fair to pose solely to you, that someone, somewhere in that agency is making essentially a political decision, whether or not to permit a discharge, of what ought to be a scientific decision. The scientific evidence, inasmuch as this layman can understand what we have been presented with, is insufficient to answer those questions. When the law says that in that case one shall not grant permits, somewhere a decision that is other than scientific is being made to proceed in the absense of clear scientific data which would allow us with confidence to answer those questions. Do you take issue with that observation?

Ms. COMPTON. No, I do not take issue with that. I think the agency shares your concern for areas of unique and biological sensitivity. However, I feel that in areas that do not rise to that level, we are able to make a reasonable judgment such as we did in the general permits in the Gulf of Mexico.

Mr. STUDDS. Right. But you also grant in the case of the resources on Georges Bank it does rise to that level?

Ms. COMPTON. Yes, I think that is the general consensus.

Mr. STUDDS. Thank you. Mr. Pritchard.

Mr. PRITCHARD. Thank you, Mr. Chairman. I guess what we are really talking about is risk. First of all, you probably have been out on these rigs since you deal with it? You have not been on the rig?

Ms. COMPTON. No, I have not. I have only been here about 3 months. I hope to get out.

Mr. STUDDS. Mr. Breaux will take you fishing any time.

Mr. PRITCHARD. I said oil rig, not fishing.

This drilling mud—how much in quantity is produced each day in an average drilling operation?

Dr. BOLTON. They probably discharge between 100 and 200 barrels of mud a day.

Mr. PRITCHARD. Two hundred barrels of mud a day in the average drilling platform?

Dr. BOLTON. Exploratory.

Mr. PRITCHARD. That is a little counter to what I have been told but——

Dr. BOLTON. The discharges are probably going to be larger on Georges Bank than perhaps you would see in the Gulf of Mexico because it is considerably different mud type that will be used. It is a lighter weight mud.

Mr. PRITCHARD. If we followed the chairman's approach here we really would not allow any drilling offshore until we have determined conclusively that these muds are not harmful or alternatives are available. What can you do with the discharge besides dumping it in the water.

Ms. COMPTON. Well, you can barge the mud to either land disposal site or to an ocean dumping site and that is what the operators of some of the rigs are doing in Santa Barbara right now and will have to do.

Mr. PRITCHARD. You mean they haul it out to a safer place in the water, less dangerous?

Ms. COMPTON. That is correct.

Mr. PRITCHARD. It would be silly to take it to shore?

Ms. COMPTON. Not necessarily. There may be safe places on land to dispose of the muds, whereas they would have a significant adverse impact on the environment, the marine environment such as the Flower Gardens.

Mr. PRITCHARD. I see. When do you think you would have the answers to the chairman's questions?

Ms. COMPTON. With regard to whether we have sufficient data to issue permits in the Georges Bank? Well, we are reviewing those applications right now and we are awaiting the data from industry on the muds that they intend to use. We expect to propose the draft permits in December, so we should have the data by late November or early December.

Mr. PRITCHARD. But as I understand his statement, some of these things cannot be decided for a long time.

Ms. COMPTON. One approach to the chronic problem is to issue short-term permits. We are contemplating issuing only 1-year permits in the Georges Bank. That is one option, that is——

Mr. PRITCHARD. You mean a 1-year permit for a person to establish a drilling rig?

Ms. COMPTON. Well, that is all the company has asked for.

Mr. PRITCHARD. I see.

Ms. COMPTON. One option is to allow them to discharge during that 1 year and for us to monitor the amounts, the discharge, the concentrations and also to monitor the data and effects, in other words, the dispersion, where the muds go, what effects they have during that year and follow up with a subsequent year of monitoring to determine the long-term effects. That is one option we may choose. Or we may choose to, as I said before, not permit any discharge.

Mr. PRITCHARD. All right. I have no further questions, Mr. Chairman.

Mr. STUDDS. Mr. Breaux.

Mr. BREAUX. Thank you, Mr. Chairman. Thank you Ms. Compton for your testimony. It is unfortunate that having been here only 3 months I guess you are involved in such detailed questioning about the in's and outs of some very technical subjects.

Just out of curiosity, what were you doing before you became involved in this mess?

Ms. COMPTON. I was the Enforcement Director in EPA's Philadelphia office.

Mr. BREAUX. I sometimes get the impression that this whole area of offshore drilling is such a novel type of program that we do not know anything about it, we have never studied it, we do not know the effects of it. When in truth and in fact that is really not correct. There are numerous studies, are there not, that really go into very scientific consideration of the effects of the offshore oil and gas industry. Is that correct? We cannot say that we have been having it for 30 years and we really do not have any studies associated with the potential adverse effects of offshore drilling, can we?

Ms. COMPTON. I would like Dr. Bolton to address that in more detail. I know my impression in making some decisions on these permits has been that the results of the studies, although they are numerous, are conflicting. That is one reason why we feel we need more data, is because the results of the various studies are not conclusive. Although I agree with you they are extensive on some subjects such as coral reefs, particularly the impact of pollution on coral reefs.

Mr. BREAUX. I am pleased we are giving a great deal of attention to the Georges Banks area, as chairman of the Fisheries Subcommittee it is in fact one of the most valuable fisheries in the world. But the district I represent has been having offshore drilling for 25, 30 years. No one at any level, has ever said, hey it is really a problem. Has not EPA been looking at what has been happening in the gulf for 25 years?

Ms. COMPTON. Again Dr. Bolton may be able to give you more detail. But we do not have baseline studies of what the gulf looked like before the drilling began. So it is difficult to assess the impact of the drilling. Another thing I have been advised in spite of increased technology with respect to fishing we have not increased our catches in the Gulf of Mexico. I do not know whether that is significant.

Mr. BREAUX. Run that by me again.

Ms. COMPTON. I have been advised that——

Mr. BREAUX. By whom?

Ms. COMPTON. By staff.

Mr. BREAUX. Is that National Marine Fisheries staff or EPA staff?

Ms. COMPTON. EPA.

Mr. BREAUX. With their expertise in fisheries.

Ms. COMPTON. No——

Dr. BOLTON. I believe it is the NAS report which makes that statement, National Academy of Sciences.

Mr. BREAUX. National Science Foundation, what does the statement, I would like to make it part of the record.

Dr. BOLTON. The statement was also quoted in the earlier hearing but it was to the effect that while you have approximately the same catch that you had 10 years ago it is taking ten times the effort. So the catch of fish has not decreased, however it is taking more effort to achieve that same catch.

Mr. BREAUX. I would like you to supply that, since you refer to it.

Dr. BOLTON. Certainly.

Mr. BREAUX. Would you address what she was talking about on the studies there.

Dr. BOLTON. Pardon?

Mr. BREAUX. She asked you to respond to the number of studies that I said must be in existence somewhere.

Dr. BOLTON. Yes, there are a number of studies. I think one of the greatest advantages of those studies is that they provided study assessments which allow for the design of more effective and informative studies. The biggest problem is that an industry has been trying to assess its effect upon the environment in what is essentially a new area—well, at that time a new area of ecological investigation. We have found a lot of pitfalls in these studies as they are assessed. The point is because you have studies does not necessarily mean the studies are the end-all and be-all of the scientific expertise. They have a lot of room for improvements. That is part of the reason why we analyze the results of these rig-monitoring studies is to improve their design so we can get more explicit answers on impact and environmental change.

Mr. BREAUX. I am all for studying. We can study the studies and study those studies; do reports on the studies of the studies. At some point we are going to have to make a decison whether to go or not go. I do not think study ever indicates in actual truth and veracity whether something is safe or harmful. Are you all familiar with the Rice University studies entitled "Offshore Ecology Investigation"?

Dr. BOLTON. Very familiar.

Mr. BREAUX. What is your thought about that?

Dr. BOLTON. I feel there are a lot of flaws in many of those studies. The volume recently released has corrected many of the flaws in the original final draft papers. However, the main problem with that study, as I think you will note in the critique section of that volume, is the study design. The critique may be about the third or fourth chapter. The authors point out that there are no sufficient control sites for those studies. It is very difficult to run a scientific experiment without proper controls.

Mr. BREAUX. Can you say if a Member of Congress wanted to get brought up to date on the effects they should not read it?

Dr. BOLTON. No; I would certainly read it. But I am not sure you can take everything in there at face value. You have to use a discretionary mind.

Mr. BREAUX. You should have another study to see if this study is accurate?

Dr. BOLTON. There already has been one. There has been a rather good critique made by one of the Woods Hole scientists.

Mr. BREAUX. What does he say?

Dr. BOLTON. He points out a number of flaws——

Mr. BREAUX. Has someone studied his study yet?

Dr. BOLTON. I really do not know. Probably the oil company has studied Dr. Sanders' study, I imagine.

Mr. BREAUX. I would like to incorporate this as part of the record, Mr. Chairman, not to have it printed or anything but just incorporated by reference, since it is such a large volume. It is entitled "Rice University Studies Offshore Ecological Investigation," put together by a research consortium of a number of universities, it was edited by a number of pretty distinguished editors who did not take part in the study, just as a matter of reference to our study.

Mr. STUDDS. Who funded it?

Mr. BREAUX. By the universities and I would imagine also by the industry.

Dr. BOLTON. The Offshore Operators Committee and several mud companies funded it.

Mr. BREAUX. I would hope so. It is dealing with their business. It is a study by the universities and I am sure the nasty old oil companies probably had something to do with helping to fund it. I want to make that very clear right now. OK. Are you familiar with what California has done with regard to the question of barging or discharging drilling muds?

Ms. COMPTON. Are you saying the oil rigs in California?

Mr. BREAUX. The State of California used to require that drilling muds be barged on shore and disposed of on shore. The California legislature by unanimous vote of both the House and the Senate out there decided that disposing of drilling fluids, muds at sea was a safe method of doing it. But prior to that a California Lands Commission study went into great detail on whether they should or should not make that recommendation. The study indicated that it was better to dispose of it at sea and made some conclusions which would indicate that they could in fact do it without any significant deleterious effects on the environment. Is EPA familiar with what the California Land Commission study said?

Dr. BOLTON. I am somewhat familiar with it. I believe most of their determination was based on something pretty much of a qualitative assessment rather than a stringent quantitative assessment.

Mr. BREAUX. Most everything is, is it not?

Dr. BOLTON. No, sir.

Mr. BREAUX. Pardon me?

Dr. BOLTON. It is not.

Mr. BREAUX. It is not?

Dr. BOLTON. No; it is possible to do a technically sound quantitative assessment, but not if the bulk of your studies are based on submersibles or less rigorous analytical tools without doing benthic sampling and analysis.

Mr. BREAUX. I take it you do not agree with the California Lands Commission study?

Dr. BOLTON. I do not think I have all the information upon which to base the decision.

Mr. BREAUX. You sound like you do not like it.

Dr. BOLTON. That is possible, personally I may not like it.

Mr. BREAUX. Oh, boy.

Secretary Andrews—I would like to make this part of the record—in response to hearings held in the other body with regard to the disposal of drilling muds in particular, referred to studies and about the number of studies that we had and the number of monitoring programs that we already have. And they say that a task force was convened, a biological task force was established in October of last year and it has been meeting regularly and that that task force has developed a program of monitoring and research which directly tracks the provision of the legislation they were considering in the other body. And he states further, "Neither EPA nor Interior is allowing any activity on the OCS which presents foreseeable significant adverse impacts to fisheries or any other resources."

Ms. COMPTON. I am sorry, I was somewhat confused. On what do you want our opinion?

Mr. BREAUX. Well, the Secretary in a letter to members of the committee in the other body who were considering legislation to change the procedure in which drilling fluids are held, particularly at the Georges Bank area, the Secretary said in a written letter to the Senate he felt the bill that they were considering adds nothing to the authorities which are already in place. He says a biological task force identical to the one that the bill called for was established in October of last year and has been meeting regularly. The task force has developed a program of monitoring and research which directly tracks the provisions of the legislation and he says decisions on permanent conditions for the control or discharge of drill fluids and cuttings under the Clean Water Act are being made regularly in frontier areas by EPA. "Neither EPA nor Interior is allowing any activity on the OCS which presents foreseeable significant adverse impacts to fisheries or any other resources."

Ms. COMPTON. Yes; I am sorry, I understand your question now. The agency does agree with the Secretary's letter and feels that there is adequate legislation and authority available to us to regulate water quality with regard to oil drilling rigs and that with the activities and assessments that we are making, we have enough authority right now to protect those areas.

Mr. BREAUX. What would EPA's position be, as to whether EPA or industry or someone has to prove that the drilling muds that are used in drilling operations would in no way be harmful before Government regulates that activity? What I am trying to find out is what is EPA's feeling on where the burden should lie before regulations are established?

Ms. COMPTON. Well, under section 403 of the Clean Water Act, EPA or the State in some cases, the permitting authority has to make an assessment of what adverse impacts would result from the discharge of pollutants. In order to make that assessment we ask the applicant for a permit, to supply us with data that will enable us to make that assessment. So the burden really lies with industry to give us enough data to show we should issue that company a permit to allow them to discharge those pollutants.

Mr. BREAUX. You could only deny a permit if it is shown that whatever is attempted to be permitted would, in fact, cause some harm or potential harm to the environment?

Ms. COMPTON. Well, there are several criteria under section 403 of the act which we have to use in assessing whether there would be harm or degradation of the waters as a result of the discharge.

Mr. BREAUX. There is no legislative problem in EPA obtaining the information necessary to find out what chemicals or potential toxics if any, would be contained in drilling fluids, is there?

Ms. COMPTON. No, there is not. There have been some comments made with regard to the confidentiality of the contents of drilling muds. However, we can obtain from industry the toxics that are in the drilling muds and their concentrations. That which is proprietary is the percentage of elements that are in these particular muds and there is no need for us to have that information. We do have such authority under section 308 of the Clean Water Act to obtain the data on drilling muds that we need to make a decision.

Mr. BREAUX. Do your biologists tell you that the percentages of the various chemicals are necessary in order to make a determination whether it could be potentially harmful or not?

Ms. COMPTON. What is important is the concentration of the toxics; for example, whether they are 10 milligrams per liter, of whatever is discharged.

Mr. BREAUX. I see. So if you have the concentrations your scientists tell you that is sufficient to make a projected decison on the potential harm?

Ms. COMPTON. That is what I have been advised.

Mr. BREAUX. So it is clear from EPA's perspective that one of the conditions prior to granting a permit for the discharge of anything at an offshore drill site, that EPA has sufficient authority to require of the applicant to disclose to EPA the type of chemicals that the permit would cover as well as the concentration of those chemicals?

Ms. COMPTON. That is correct.

Mr. BREAUX. Thank you very much. Mr. Chairman, I would like if we could include for the record, it is just a page and a half letter I referred to from Secretary Andrews with regard to the subjects that I referred to.

Mr. STUDDS. Without objection.

[The information follows:]

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
*Washington, D.C., August 19, 1980.*

Hon. J. BENNETT JOHNSTON,
*U.S. Senate,*
*Washington, D.C.*

DEAR SENATOR JOHNSTON: I have reviewed the new amendment to S. 2119 regarding the protection of fisheries on the Georges Bank which is now before the Senate

Energy and Natural Resources Committee. A number of modifications have been made in the proposed substitute which are responsive to the concerns I expressed in my previous letters to Senator Jackson regarding two earlier versions of the bill. I appreciate the movement away from provisions which would greatly obstruct or prevent oil and gas exploration on the North Atlantic Continental Shelf.

The bill as now written, however, adds nothing to authorities which are already in place or activities that are already underway. A Biological Task Force identical to the one in the bill was established in October of last year and has been meeting regularly. The Task Force has developed a program of monitoring and research which directly tracks the provisions of the bill, and has formally recommended it to this Department where it is under expedited review for funding. Decisions on permit conditions for the controlled discharge of drill muds and cuttings under the Clean Water Act are being made regularly in frontier areas by EPA. Neither EPA nor Interior is allowing any activity on the OCS which presents foreseeable significant adverse impacts to fisheries or any other resources.

To be frank, I can see no purpose served by passage of this legislation. But I can see considerable risk if it is reported by the Energy Committee.

First, it greatly enhances the prospects for floor action on the Commerce Committee bill, with its rigid zero-discharge requirement, which the Administration and I strongly oppose as tantamount to an exclusion of oil and gas exploration on Georges Bank.

Second, any new legislative guidance at this point will greatly upset the painstaking progress we have made toward a reconciliation of interests in the North Atlantic, a process which has involved intense interagency and Federal-State negotiations and a long-running lawsuit which was initiated in January 1978 and is just now approaching a new round of trial activity this fall.

Third, it will set a precedent for special regionally-based legislation which will seriously threaten the reliability and even-handedness of the national program established by Congress under the OCS Lands Act, as amended.

I ask that you allow the progress we are making in the North Atlantic to proceed without the uncertainty, dislocation, and renewed contention that would accompany passage of this legislation. I also ask that you allow us to continue implementation of the OCS Lands Act as the operative statute crafted by your committee to assure environmentally sound operations everywhere on the OCS.

Sincerely,

CECIL D. ANDRUS,
*Secretary.*

Mr. STUDDS. Let me also for the record read in an exchange from the earlier hearing this year of this subcommittee on precisely this subject. The question of whether or not important information is proprietary and withheld. I quote my question to EPA's own scientist Dr. Richards:

What do we know about the composition of these animals (drilling muds)?

Dr. RICHARDS. The problem is not so much what we know, but what we do not know. Drilling fluid is a complex mixture of mixtures. The ingredients include a wide variety of chemicals. The problem is some of them appear to be proprietary. The American Petroleum Institute's component listing states that fact. Another problem is that these mixtures appear to undergo transformations downhole. We know some of the things that go into the drilling fluids, but we do not know them all. Drilling fluid components contain contaminants—they are not pure chemicals—they are complex mixtures of industrial grade chemicals. Only the trade names of most chemicals are known. The problem is: in order to do predictive toxicology and predict what effect, these things would have on organisms, we really need more information on the chemical analysis.

Dr. PARSONS (NOAA). I agree with Dr. Richards' statement also. In my review of permit applications, there is often mention of additives used in the drilling mud, but usually very little indication of what they are or what their concentration may be. I have before me a list of 15 categories of drilling fluid additives commonly used: lubricants, flocculants, bactericides, et cetera. I have no idea of what chemicals are found in these additives nor what their toxicities are. This information is not provided in drilling permits.

So the scientists do not seem to agree with your characterization.

Ms. COMPTON. Well, since April we have begun taking a new look at the way we are approaching permitting these facilities and one

point is that, as I mentioned to you, we are asking for bioassay and bioaccumulation data on the 8 to 10 classes of muds which industry says they will use in the Georges Bank. After reviewing that data we will probably conclude that if we are to allow the discharge of muds and cuttings in Georges Bank that they will be limited to those muds and cuttings that they have tested and submitted the data to us, that we do not—although what was stated earlier to the subcommittee is true and I am not changing that testimony in any way, I am saying that we do not necessarily need to know the entire universe of the muds before we decide what to do with particular drilling rigs if they are limited to the use of certain muds.

Mr. STUDDS. I will let the record reflect what the testimony of the scientists were. I am not sure it is consistent. I apologize Mr. Wyatt, it is your time.

Mr. WYATT. Thank you, Mr. Chairman. You said that the Rice study was reviewed and studied by a scientist from Woods Hole, is that right?

Dr. BOLTON. The what study?

Mr. WYATT. The Rice University study.

Dr. BOLTON. I am sorry. Yes; Howard Sanders has done a review of it. It is not in publication yet. Since he has no funding I do not know when it will go into production.

Mr. WYATT. So only one person studied it?

Dr. BOLTON. He is a rather well respected marine benthic biologist.

Mr. WYATT. Twenty-three universities were involved with the Rice University study.

Dr. BOLTON. That is right.

Mr. WYATT. We are talking one study of that and raising questions, that is what you are saying?

Dr. BOLTON. Yes. It is not the only basis for my comment. I have also read most of the original papers involved in that study and I have a consultant who is looking at the new addition of the studies now. There is a reasonable question as to its adequacy. I think industry in many ways also questions some of those studies.

Mr. WYATT. Industry questions the studies?

Dr. BOLTON. Yes, for the very same reason. It is a scientific study done basically without control sites, based on inadequate design.

Mr. WYATT. And that is the primary objection?

Dr. BOLTON. That is one of the primary objections, yes.

Mr. WYATT. Someone made a comment a moment ago that in the Gulf of Mexico you are getting the same catch with ten times the effort, is that correct?

Dr. BOLTON. Yes.

Mr. WYATT. That is not true of the Georges Bank area for instance?

Dr. BOLTON. I am not familiar with any similar statistics on Georges Bank.

Mr. WYATT. Any other fish areas in the country that we know of that do not have the same catch with more effort, or are you just familiar with the Gulf of Mexico?

Dr. BOLTON. I am familiar with that particular study and citation.

Mr. WYATT. Have any other studies been made?

Dr. BOLTON. I do not know if NAS funded other studies in other fisheries areas. They specifically brought out the gulf situation.

Mr. STUDDS. The National Marine Fisheries Service has regular annual figures on fisheries production throughout the country.

Mr. WYATT. National Marine Fisheries.

Ms. COMPTON. National Marine and Fisheries Service.

Mr. WYATT. Have they indicated that that is the case?

Dr. BOLTON. Dean Parsons who was at the hearing referenced by Mr. Stills is a representative of that organization and I do not remember him making any addition to that statement.

Ms. COMPTON. We would be happy to collect that.

Mr. WYATT. I think that would be interesting to know. If we are going to throw out something that may raise a question, I think we ought to compare it with the other fishing areas of the country to make a determination if there is any significance in that fact. There may be absolutely no significance or correlation with tremendous amount of drilling taking place in the Gulf of Mexico. Every other fishing area in the country might also have the same catch.

Ms. COMPTON. As I commented to Mr. Breaux, I did not indicate whether we knew there was any significance to that data or not. I simply commented in response to the fact that he said there had been no problems in the Gulf of Mexico. It is our understanding that we are not sure whether there have been any problems as a result of the drilling, because there are no baseline studies indicating what the gulf was like prior to drilling and the catch in the Gulf of Mexico has not increased in spite of increased use of equipment and personnel. We would be happy to supplement the record with information on other fishing areas.

Mr. WYATT. Do you know if you are doing any of those kind of studies?

Ms. COMPTON. NOAA is, I am sure.

Ms. COMPTON. EPA is not involved in that type of study.

Mr. WYATT. You say on page four of your testimony:

> After review of comments received on the draft permit, the permitting authority may issue or deny a final permit. After the final permit is issued, any interested party may contest its issuance or its terms within 30 days.

Who would any interested party be?

Ms. COMPTON. In the Flower Gardens area, the Natural Resources Defense Council, as you know.

Mr. WYATT. That is an environmental group?

Ms. COMPTON. Yes, it is a national environmental group.

Mr. WYATT. How are they funded?

Ms. COMPTON. They are funded by over 100 foundations, to my knowledge.

Mr. WYATT. Is it a nonprofit corporation?

Ms. COMPTON. Yes, it is.

Mr. WYATT. OK. They could object and have objected?

Ms. COMPTON. Yes. They requested that an evidentiary hearing be held on the terms of the permit. They questioned its terms in the Flower Gardens.

Mr. WYATT. This was after you issued the permit?

Ms. COMPTON. Yes.

Mr. WYATT. Your scientists had determined that it could be issued?

Ms. COMPTON. Yes. EPA issued the permit on that basis.

Mr. WYATT. Has anyone else objected to it?

Ms. COMPTON. Yes, the National Wildlife Federation requested an evidentiary hearing. That is also a national environmental group.

Mr. WYATT. Do you know if there is any connection between those two groups?

Ms. COMPTON. None, other than that the personnel know each other.

Mr. WYATT. What about the funding, do you think that might be the same?

Ms. COMPTON. The National Wildlife Federation to my knowledge is funded by its members. The Natural Resources Defense Council seem to rely on foundation funding as well as members for funds. Also the industries who receive those three permits requested an evidentiary hearing also because they did not agree with the terms of the permit.

Mr. WYATT. Can you tell me if the law that requires the permit gives any interested party the right to request an evidentiary hearing?

Ms. COMPTON. Our EPA regulations permit any interested party to request——

Mr. WYATT. Your regulations. Does the law require that?

Ms. COMPTON. That any interested party? I would imagine that the Administrative Procedures Act permits any interested person to challenge a Federal agency action, final Federal agency action. And I am not familiar with the Clean Water Act's provisions.

Mr. WYATT. Could you tell me how you become an interested party?

Ms. COMPTON. Pardon?

Mr. WYATT. Could you tell me how you become an interested party?

Ms. COMPTON. In other words how an interested party——

Mr. WYATT. Yes. Am I an interested party or Dr. Oppenheimer for instance in Texas an interested party? How do you become an interested party?

Ms. COMPTON. I believe our consolidated permit regulations define interested party. I am not familiar with that definition. I assume it is someone who may be affected by the agency and the environmental groups would be affected because their charter is to protect the environment and they have an interest, and their members live in the area where the environment may be adversely affected.

Mr. WYATT. Can you tell me what studies you are currently doing in the Gulf of Mexico?

Dr. BOLTON. Mainly working with larval recruitment and settling studies, a number of coral studies both in chronic and acute effects of drilling fluids on the corals. They are working with a number of studies of heavy metal bioaccumulation, particularly in shrimp. I believe that there are also studies ongoing on fish development and behavior.

Mr. WYATT. Have you found if there is any major damage, or any damage, in the studies you have conducted thus far in the gulf?

Dr. BOLTON. The indication that we have from our field scientists is that there is cause for concern.

Mr. WYATT. That is not my question. Have you determined that there is damage being done, not cause for concern but is there damage being done?

Dr. BOLTON. I think that you can say that even in the BLM rig studies that have been done, there is damage being done as a result of drilling operations in the immediate vicinity of the rig, yes, sir.

Mr. WYATT. And that damage is considered to be significant?

Dr. BOLTON. It is certainly significant within the limitations of the rig radius, yes.

Ms. COMPTON. Depending—I think the agency's position depends on the area affected by the rig. In other words, there are many areas in the Gulf of Mexico that are not of significant biological concern where we would consider the damage not to be significant. However, in the Flower Gardens we decided that the damage may be significant, given its unique characteristics.

Mr. WYATT. Unique characteristics?

Dr. BOLTON. The northernmost hard coral bank.

Mr. WYATT. What damage is being done there?

Dr. BOLTON. To date?

Mr. WYATT. Yes.

Ms. COMPTON. There is no drilling there now.

Dr. BOLTON. No, there has been drilling there.

Any damage that may have been done has not been directly tied with drilling effects, simply because the scientific community has not known about the Flower Gardens for that long. Fishermen did. Texas A. & M. I believe was credited with actually discovering the unique nature of the Flower Garden Banks. I am not sure of the date.

Mr. WYATT. And you have been looking at this, you have been looking at Flower Gardens, and you have found no significant damage, is that correct?

Dr. BOLTON. The Bureau of Land Management says there has been no significant damage.

Mr. WYATT. What about EPA?

Dr. BOLTON. I do not know that EPA has the field studies that to substantiate that cause and effect EPA has not been doing field studies directly at the Flower Gardens.

Mr. WYATT. Are you familiar with any study that shows that there is significant damage done by oil drilling?

Dr. BOLTON. There is a USGS coral coring study that indicates that there has been a decrease in the growth of corals beginning about 1957. But there is no way to really attribute that decrease directly to drilling activities. There are certainly many other factors that could influence coral growth rate.

Mr. WYATT. Do you have any studies that show that you will ultimately come to a conclusion of any kind?

Dr. BOLTON. There are completed EPA studies which indicate a change in recruitment and larval settling as a result of fine layers of drilling fluid on the substrat, so, yes——

Mr. WYATT. On?

Dr. BOLTON. Trays containing different concentrations of drilling fluid are placed on the ocean bottom. A fine layer, I think about 2 millimeters, on that mud tray will change the structure of the community that settles there. So the change in community structure is an impact. Fish often feed on these benthic organisms.

Mr. WYATT. In and around the area?

Dr. BOLTON. These were done off of Pensacola, I believe, on EPA's Stage I. So it is a field study but it was not done at the Flower Gardens. It was simply done with drilling muds that are used in the Gulf of Mexico.

Mr. WYATT. That would be during the time of drilling?

Dr. BOLTON. These were muds taken off of drilling rigs during operations and then layered or mixed with azenic muds on trays which were set out along with control trays and larval organisms were allowed to settle on those trays. The control trays were compared with the experimental trays. The results indicated that, yes, the benthic community was affected.

Mr. WYATT. For what length of time?

Dr. BOLTON. It was the length of the larval settling. I am not sure what the period of time used was. It was long enough to get a crop of larval organisms.

Mr. WYATT. Which would lead us to believe that there is a reduction——

Dr. BOLTON. That there is some change, certainly, in the Benthic community as a result of the presence of drilling fluids.

Mr. WYATT. Can you project from that kind of a study what the ultimate damage would be to the entire Gulf of Mexico or to a certain portion of the Gulf of Mexico?

Dr. BOLTON. That is one of a complex of studies which will be used to make that type of assessment. But all of the studies are not completed.

Mr. WYATT. How long will it be before the studies are completed?

Dr. BOLTON. I believe our field scientists are planning to complete the effects studies by 1982.

Mr. WYATT. This is being done off the coast of Florida?

Dr. BOLTON. These studies are part of a comprehensive program. Part of it is being done off Florida and in the gulf area, but part of it also is being done in New England in a number of marine labs. A lot of the work is being done by marine researchers as contractors for EPA, paid for by EPA.

Mr. WYATT. In collecting samples do you find a greater, higher residue of toxicity in the Gulf of Mexico that could be attributed to drilling muds than you do in other areas?

Dr. BOLTON. You certainly find higher concentrations of some of the heavy metals than you would find in many other areas. That is what makes much of the field studies very difficult to interpret, because the baseline of heavy metal contamination is so high. Initial experimental sampling that might be considered a significant increase in heavy metals concentration with a low baseline would be statistically nonsignificant given the high baseline. So it makes it difficult to make those interpretations in the Gulf of Mexico and certainly to extrapolate to other areas.

Mr. WYATT. Because you start with a higher baseline of heavy metals.

Dr. BOLTON. For instance, if you were to have a baseline of heavy metal concentration of 50 to 100 parts per million (ppm), perhaps in Baltimore Canyon or Georges Bank, you might typically find a baseline of 300 or 400 ppm in some parts of the Gulf of Mexico. These are purely hypothetical values. An increase of 5 to 10 ppm would be significant in the first instance, and not significant in the latter. The starting level of the contamination of the muds is much higher. Whether all of the contamination in the gulf is from drilling effluents is questionable; I certainly would not want to be held to it. There is an awful lot of contamination in the Gulf of Mexico coming from the Mississippi River which spreads across a good bit of the northeastern gulf shelf.

Mr. WYATT. Have we shown damage from heavy metals, the difference in the 3 to 400 parts per million?

Dr. BOLTON. There are a number of studies which could indicate that the level of chromium and other heavy metals found certainly could be a cause of concern. Chromium is one of the higher constituent metals of drilling fluids. Cadmium is also found in higher concentrations in the area, and that is a very toxic metal.

Mr. WYATT. That has shown up in shrimp, fish?

Dr. BOLTON. These references are from sediment studies.

Mr. WYATT. Well, what is the problem with those high concentrations, I guess is what I am asking.

Dr. BOLTON. All right. Many fish and other organisms feed on and in the benthos, in the muddy substrate. And if organisms are living in that material and are benthic feeders, they may concentrate or at least accumulate a certain amount of heavy metals from that sediment. Those organisms in turn can be eaten by other organisms. So it is very possible to pass concentrations of heavy metals through the food chain. The example used before of Minamato Bay in Japan, with mercury contamination, is a good demonstration of this effect.

Mr. WYATT. You then from these basic studies of sediment have detected a higher concentration of either cadmium or chromium in shrimp from the Gulf of Mexico?

Dr. BOLTON. In the sediment. I am basing most of what I am saying on sediment data. BLM's EIS on one of the gulf areas specifically makes reference to the higher concentrations of heavy metals 2 years after the location of the drilling rig.

Mr. WYATT. Of the what?

Dr. BOLTON. Of a rig in a sediment area. So I am really basing my comments on the sediment concentrations. I am not that familiar with the concentrations of the heavy metals in the organisms, not so much because some of those measurements have not been made, but in many cases because the measurements were made of whole animals rather than of organs where metals might be concentrated. This approach results in an immediate dilution of the concentrations of heavy metals.

Mr. STUDDS. We will go around again if the gentleman has more questions. I want to slip in, if I may, some questions that remain here.

Will the EPA discharge permits be submitted to the States for consistency determinations under the Coastal Zone Management Act?

Ms. COMPTON. I believe they have to be.

Mr. STUDDS. They will?

Ms. COMPTON. I believe so.

Mr. STUDDS. OK.

Ms. COMPTON. We have already been meeting with some of the States with regard to coastal zone management compliance.

Mr. STUDDS. Your proposed rule for ocean discharge criteria requires that an NPDES permit applicant must analyze all alternative methods of reducing or eliminating pollutants.

I assume that in the case of drill muds, barging offsite is one such possible alternative?

Ms. COMPTON. Certainly.

Mr. STUDDS. If you reach the determination that you could not justify granting a permit for dumping into the water of these materials, is your statutory responsibility such that all you could do would be to simply deny that permit or could you also require or recommend alternative methods of disposition?

Ms. COMPTON. Well, it seems to me that we could put in the permit a limitation that would not allow the discharge of the drilling muds and cuttings and that it would be up to the applicant, the discharger, to find a place to take his drilling muds and cuttings.

Mr. STUDDS. Now if you, in an OCS area, were to deny permission to discharge the drill muds, does the Department of the Interior, to your knowledge, have the statutory authority by virtue of some other statute to ignore your recommendation and somehow proceed in the granting under their permitting process of authority to dump the discharge?

Ms. COMPTON. I believe that we have exclusive authority under the Clean Water Act to determine what discharges go into the ocean.

Mr. STUDDS. So whether or not Interior agreed with your findings, they would be final under the law with respect to these requests?

Ms. COMPTON. That is right.

Mr. STUDDS. You made reference, heaven help us all, to a new task force for drilling muds and formation waters. Does it actually do research? What is it, who is on it, when was it established, and what is its relation to the famous biological task force on Georges Bank?

Dr. BOLTON. It is chaired by a representative from the Office of Research and Development.

Mr. STUDDS. Is that an EPA task force?

Ms. COMPTON. It is an internal task force to coordinate the Ocean Programs and Research and Development Offices and other technical offices to make sure we all know what we are doing.

Mr. STUDDS. I see. You don't have a task force for intertask force relationships, do you?

Ms. COMPTON. I am sure we do.

Mr. STUDDS. I am sure you do. I am sure someone thinks they are interfacing. When do you think your regulations on ocean discharge will be final?

Ms. COMPTON. We are under court order to promulgate those regulations by September 30, 1980.

Mr. STUDDS. 1980?

Ms. COMPTON. Right.

Mr. STUDDS. You did make reference at one point in your testimony to some regulations being ready in approximately 18 months. What were they?

Ms. COMPTON. Those are new source performance standards for the offshore oil and gas subcategory of oil and gas production or oil and gas facilities.

Mr. STUDDS. When do you expect to issue draft permits for Georges Bank?

Ms. COMPTON. By December of this year. That is the schedule that we have right now. We expect that the bioassay and bioaccumulation data to be into the region 1 office in Boston by the middle of September. We have some of it now.

Mr. STUDDS. So extrapolation can get under way in earnest by the end of September?

Ms. COMPTON. We will be reviewing the data on an ongoing process.

Mr. STUDDS. Dr. Bolton, you look like you were about to say something.

Dr. BOLTON. No, I am just cold.

Mr. STUDDS. It is very cold.

Dr. BOLTON. Yes.

Mr. STUDDS. Are there any other questions?

Mr. Breaux?

Mr. BREAUX. What I am trying to get set in my mind is that a permittee who applies for a permit from EPA gives you the concentrations of all of the chemicals that make up drilling fluids—is that correct?

Ms. COMPTON. And then what?

Mr. BREAUX. Is that correct, so far, a permittee who applies for a discharge permit to discharge drilling mud, you ask them to provide you with information and I take it from your testimony what you ask them to provide you is the makeup of the drilling muds and the concentrations of various chemicals that make up drilling mud?

Ms. COMPTON. We ask them for the chemical elements in the drilling muds and for the concentrations. I would steer away from the word makeup.

Mr. BREAUX. You don't get the percentages but you get the concentrations of the chemicals that comprise the drilling fluids?

Ms. COMPTON. Yes.

Mr. BREAUX. What do you do with it then?

Ms. COMPTON. The information?

Mr. BREAUX. Yes.

Ms. COMPTON. Well, we are also waiting for more information, as I indicated earlier, from the applicants to determine whether those chemicals and those particular muds will cause acute or chronic toxic effect on the marine organisms that may be——

Mr. BREAUX. Is there a Federal statute somewhere that says that the applicant has to bear that burden or is that a regulatory decision on the part of EPA?

Ms. COMPTON. I believe section 308 of the Clean Water Act gives us the authority to request from any applicant or any discharger

information that would enable us to make a decision on the impact of their activities on the receiving——

Mr. BREAUX. Suppose an applicant says, "Look, there are 18,000 studies on this, I don't know which one to believe. People are studying the studies. But here is the concentration, I want a permit."

Can you deny the permit without showing that it is harmful?

Ms. COMPTON. We can ask him for the bioassay and bioaccumulation data. If he doesn't submit that data, I believe we have the authority to deny the permit.

Mr. BREAUX. That is kind of big—you believe. Are you in charge of granting the permits for EPA?

Ms. COMPTON. Yes, I am.

Mr. BREAUX. You are not sure whether the burden is on the applicant or is on the EPA to say this is not healthy? That is the critical point, whose burden it is?

Ms. COMPTON. I agree. And it is my understanding if they do not submit the data that we think is necessary to make a decision on whether they can discharge a particular pollutant, we can deny them a permit to discharge the pollutant.

But I would feel more comfortable in supplementing the record.

Mr. BREAUX. I would like to see it, not only for the record, I would like you to submit to me and also to the committee an answer to exactly what I asked, whose burden it is? I get somewhat disturbed by our Government that can say unless you can prove it is not harmful, we are going to say you can't do it. It seems to me it is incumbent on the part of the Government and regulation saying in our opinion you have given us this information and our studies indicate that it is not something we can accept.

But the information I have here this morning is we have a lot of studies and everybody is studying the studies but none of them are definitive and final. Therefore, it is impossible for anyone to make a case that they would in no way create potential harm; that is, a permit would never be granted under that scenario?

Ms. COMPTON. Congress, in section 403 of the Clean Water Act, I emphasize, gave the EPA the responsibility to determine with regard to ocean dischargers whether there would be degradation of those waters; in order to make that determination we need the information called for in the act.

Mr. BREAUX. They give you information on what they are dumping in the water, there is no question about that, is there?

Ms. COMPTON. No.

Mr. BREAUX. Then it is incumbent upon EPA to make the decision whether it is harmful or not; it is not the burden of the applicant.

Ms. COMPTON. OK, I misunderstood your earlier question. We can ask them for information to determine its toxicity but not necessarily what actual degradation that will occur.

Mr. BREAUX. That is EPA's burden. Is that EPA's burden?

Ms. COMPTON. I would feel more comfortable if I provided this in a supplemental statement.

Mr. BREAUX. I know you have been only 3 months and I don't know what Congress is about after 8 years. I can't expect you to know all the answers in 3 months, obviously. But that is one of the

crucial questions, whether it is your agency's responsibility to make a determination when they submit these ingredients whether or not it could be harmful. That is the basis of whether or not a permit is granted. If it is not harmful, a permit will be issued.

My question is: Who makes the question on the potential harm, EPA or the applicant for the permit? There seems to be some question about that. So if you could, I would like a response in writing to the committee and also to me which would spell out how that is being handled within EPA's shop.

Ms. COMPTON. I will be happy to provide that.

Mr. STUDDS. Mr. Wyatt, did you ask for time?

Mr. WYATT. Yes.

Can you tell me if you have any evidence that shows that the shellfish, for instance, coming from the Gulf of Mexico are harmful to people who eat it at all, after 30, 40 years of drilling in the gulf, as well as a result of effluents coming into the gulf from various rivers, et cetera?

Dr. BOLTON. I am not that familiar with the public health aspect with the banning of shellfish in the gulf.

Mr. WYATT. You mean of all the studies that have been made. I don't know how many have been made.

Dr. BOLTON. I know shellfish were banned in the New England area after one of the oil spills. Human health was the rationale for the ban.

Mr. WYATT. For how long?

Dr. BOLTON. I am not sure of the length of time.

Mr. STUDDS. We have had shellfish beds closed on many occasions, some of them for years at a time, because of oil spills, 10 years in one instance.

Mr. WYATT. However, in terms of the Gulf of Mexico, you are unaware that seafood taken from the gulf, seafood, any kind, have ever been banned in this country because of toxic levels in that seafood?

Dr. BOLTON. I am not familiar with the banning of seafood from the gulf for that reason.

Mr. WYATT. Do you know how close we have come to that? Do you have any idea?

Dr. BOLTON. I wouldn't have any idea. I am sure there have been shellfish areas in the gulf, though, that have been closed off for one reason or another. It may be human waste pollution rather than oil and gas. But I would be very surprised if there had not been shellfish areas that had been closed.

Mr. WYATT. There ought to be some end result we are looking for here, not just, you know, making studies and running tests.

Dr. BOLTON. In Mobile Bay, I know that no discharge is allowed because it is a shellfish bed. So they do not allow any discharge in that area. There must be some rationale for that State having that ban. It would suggest that there was some reason for them not allowing the discharges on the shellfish.

Mr. WYATT. But you are unaware of why that was done? Did the State of Alabama make that determination?

Dr. BOLTON. I am sure the State must have been concerned about the effects of the discharges on the shellfish, however, the industry was not allowed to discharge because of the shellfishery.

Mr. WYATT. I think that is fine, but it would appear further in your work at some point in time we would look to the final result, to me, which would be the logical conclusion and that is the damage being done, the high levels of toxic material that would be found in shellfish or seafood taken from the Gulf of Mexico because I would think that is what you——

Dr. BOLTON. I know there is research being done at the New England Aquarium laboratory for EPA on shellfish from New England, looking at the bioaccumulation of heavy metals from animals exposed to drilling discharges.

Mr. WYATT. If possible, Mr. Chairman, I would like for EPA to furnish this committee with the instances where we have stopped selling, or removing, seafood or shellfish, et cetera, from the Gulf of Mexico.

Mr. STUDDS. I would like to say to the gentleman, I don't think that is within the jurisdiction of EPA. Those kinds of determinations are probably FDA determinations and that would go to the agency responsible for that question. They are not making any such claim. The gentleman is not challenging that oil is bad for fish?

Mr. WYATT. Of course not. I want to know how bad it is for fish.

Mr. STUDDS. Very bad.

Mr. WYATT. We don't know apparently.

Mr. STUDDS. I am going to ask the gentleman's permission to interrupt. Mr. Pritchard wanted to know the time frame for the Beaufort Sea draft permits?

Ms. COMPTON. We have just received four applications there and are processing them; we are waiting for some more data. It may be as long as a year.

Mr. STUDDS. Well into the Reagan administration. Tell Mr. Pritchard that.

Let me say, I appreciate your patience. You have borne up well. I have not enforced the 5-minute rule to put it mildly on myself or other members of the subcommittee, and under the circumstances you have acquitted yourself very well indeed.

Mr. Breaux left again, but I was pressing as to whose responsibility it is to determine whether or not a discharge would be harmful. I think the statute which has been cited so much today, section 403 of the Clean Water Act, makes that explicit and clear beyond any question, it is EPA's responsibility because Congress decided in that public law some 8 years ago that it would be. The administrative agency is charged with the promulgation of guidelines for determining degradation of the waters. You are also charged, I cannot resist reminding you one more time, in the event of insufficient information to make that determination, not to permit any such discharge in question.

Ms. COMPTON. My question with regard to that and my inability to answer with certain determination is because section 308 of the act allows us to collect whatever data we need to make a decision with regard to discharges into the water. And that may shift the burden back to industry who wants the discharge with regard to supplying that information.

Mr. STUDDS. If they want it, they have to come to you and they have to present persuasive information.

Ms. COMPTON. That is one of the interpretations of reading the two sections together.

Mr. STUDDS. But the final evaluation of that data is yours, not theirs.

Ms. COMPTON. Absolutely.

Mr. STUDDS. That is very clear. The record as I say will remain open. Members may wish to submit questions in writing to both agencies.

Also in the record will appear the letter which I referred to from the Commandant of the Coast Guard to Acting Chairman Ashley of this committee.

Thank you again for your patience and your attendance.

You have one more thing you wish to say?

Ms. COMPTON. I do. I hope the committee will understand the position which the agency is in given the line of questioning from the two different positions that we heard today, and the difficulty with which we face very complex questions.

Mr. STUDDS. The difficulty of the agency's position is abundantly and increasingly clear. I think the reference you make as you sit here being battered both from the gulf coast and from New England points up what I meant when I said what ought to be a scientific problem I think has become, to an extent which I deplore, a political rather than a scientific question. Your agency ought, in my opinion, to be making scientific judgments in accordance with the mandates of the statute.

I realize—in addition, you live in the same world of political reality that we all do. As you point out, today's hearing demonstrates clearly some of the conflicting pressures to which the Administrator is subjected. That presumably is why he is so highly paid.

Thank you very much.

[The information follows:]

U.S. COAST GUARD,
*Washington, D.C., July 16, 1980.*

Hon. THOMAS L. ASHLEY,
*Acting Chairman, Committee on Merchant Marine and Fisheries,*
*House of Representatives, Washington, D.C.*

DEAR MR. CHAIRMAN: I am concerned that information concerning the Coast Guard's open water pollution response plans and objectives, which appears on pages 12 and 32 of House Report No. 96-909 (accompanying H.R. 6672), may be misleading.

The national response goals established by the President's March 17, 1977 Oil Pollution message are not being implemented by the Coast Guard, nor are we in the process of deploying high seas containment and cleanup equipment at eleven strategic sites around the U.S. to respond to an oil spill of 100,000 tons within 6 hours.

The strategy recommended in the Transportation System Center Study of 1977 has been modified in the light of later experience. Specifically the Secretary of Transportation has approved for planning purposes a three year projects to improve spill response at 11 high risk areas around the country. Equipment would be stockpiled and maintained at facilities with the objective of attaining a nationwide, aggregate oil recovery capacity of 200 tons of oil per hour, conditions permitting. Implementation of this plan depends on the normal budget process, to begin in fiscal year 1982. A small amount of the equipment ultimately needed to meet this objective is now in place at three Coast Guard Strike Team locations, but as noted in the Report on H.R. 6672, more equipment and storage facilities will be needed. If the need for a further federal effort is demonstrated, the Coast Guard has suggested a ten year program expansion to a 3,300-10,000 ton/day regional goal. At this time, though, it is difficult to forecast that far into the future.

Although a prototype Zero Relative Velocity skimmer has been developed through Coast Guard R&D, a final decision to go forward with a production model has not

been made as yet, and, in any event, this small vessel is not designed for open water recovery operations. It does appear to be a significant advance in state of the art machinery capable of working in high currents encountered in relatively protected waters.

Quite candidly, I must say that I don not believe there now exists an in place capability to effectively respond to a major oil or hazardous substance spill on the OCS or Fisheries conservation zone. It will take some time before this situation improves.

Sincerely,

J. B. HAYES,
*Admiral, U.S. Coast Guard,*
*Commandant.*

QUESTIONS OF MR. STUDDS AND ANSWERS

*Question 1.* In the past, the Coast Guard has suffered from a lack of barging capability to carry spilled oil to disposal sites. Has this deficiency been corrected?

Answer. We have found that ocean service barges and suitable support vessels exist in too few numbers in most areas to permit the establishment of local standby contracts. Also operators are reluctant to interrupt existing contracts with regular employers to provide vessels on short notice. To help fill the gap when a barge is not immediately available to carry spilled oil to disposal sites, we have procured 11 portable rubber bladders ranging in size from 10,000 to 240,000 gallons. In addition, offshore drilling operators are being required to address the need for tank vessels or portable storage containers for the recovered oil/water mixture in their contingency planning.

*Question 2.* Could you provide a full inventory of containment and clean up equipment and its location which is currently available for use by the Coast Guard?

Answer. The Coast Guard utilizes all available resources, including those from commercial contractors when possible, for cleaning up pollution incidents. We assume however, that your question refers to the quantity of Coast Guard equipment available for open water use when the required resource is not available in the commercial sector.

In the area of offshore open water recovery and containment, the Coast Guard presently has 19 skimming barriers (612-ft. each) of the type we used at the Campeche Well site and 4 skimming barrier pumping systems. The inventory includes 16 Adapts which are high capacity pumping units used to offload bulk liquid cargo from a stricken vessel, 2 viscous oil pumping systems and 11 portable storage bladders, ranging in size from 10,000 to 240,000 gallon capacity. We also own 2 large rotating disk skimmers though they are not designed for truly open water use.

This equipment is located at our strike team locations on the Atlantic, Gulf, and Pacific coasts with the mix varying according to National and International needs and maintenance requirements. We are presently budgeted to increase our inventory skimming of barriers to 26 by 1982. These we plan to store at suitable high risk areas.

*Question 3.* Given the Coast Guard's inability to fulfill all of its inspection requirements under the OCSLAA due to a shortage of personnel, what sort of inspection program for offshore drilling rigs is planned for Georges Bank?

Answer. Because of resource limitations the Coast Guard is emphasizing inspections of mobile offshore drilling units and manned platforms, and omitting required inspections of unmanned units. The units that will engage in exploratory drilling on Georges Bank will be mobile offshore drilling units and will all be inspected. Inspections are generally conducted prior to the start of drilling operations and as necessary thereafter. The Coast Guard has established a Marine Safety Detachment at Hyannis, Massachusetts staffed with four personnel to perform this function. This detachment is colocated with the U.S. Geological Survey Office in Hyannis.

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DEPARTMENT OF TRANSPORTATION,
U.S. COAST GUARD,
*Washington, D.C., October 15, 1980.*

Hon. EDWIN B. FORSYTHE, and Hon. JOEL PRITCHARD,
*House of Representatives,*
*Washington, D.C.*

DEAR MR. FORSYTHE and MR. PRITCHARD: Thank you for your letter of September 15, 1980, forwarding additional questions for the record on the testimony of Captain Charles Corbett, Chief, Marine Environmental Response Division, who appeared

before the Oceanography Subcommittee of the House Merchant Marine and Fisheries Committee on August 26, 1980. Our responses are an enclosure to this letter.

We appreciate your continued interest in this topic area.

Sincerely,

J. B. HAYES,
*Admiral, U.S. Coast Guard,*
*Commandant.*

Enclosures.

QUESTIONS OF MR. FORSYTHE AND MR. PRITCHARD WITH ANSWERS

*Question 1.* What is your definition of a major oil spill of the size referred to in your statement? What is the flow rate of the blowout, the duration of the blowout, as well as the total level of spill in relationship to time?

Answer. Within the context of OCS activities, we consider a major oil spill to be one which is discharging (or expected to discharge) at the flow rate of 1000 barrels during a 24 hour period. Since any blowout would include the threat of such a flowrate, it would be considered a major incident. There may be other occasions when a spill of lower actual discharge would be considered major; for example if an especially sensitive environmental condition existed at the time of the spill.

*Question 2.* What do you mean by your statement that you could not respond to a major oil spill? Does that mean you could not attempt to contain or disperse the spill, or does it mean you could not completely recover the oil? Please be specific on all accounts.

Answer. Indeed, weather conditions permitting, we would attempt to contain, recover or disperse the spill (providing the discharger was not taking adequate action). It would be a rare occasion when, even with good weather, we could recover all of the oil. We do not believe that there exists an inplace capability to be fully responsive to a major oil spill on the OCS.

*Question 3.* Have you ever claimed you could completely retain and recover the oil from a major oil spill?

Answer. We have no recollection of consciously claiming that we could completely retain and recover the oil from an offshore discharge. On the other hand, we have often said recently, that oil spills are difficult to deal with, often hampered by weather, and that there is no one universal mechanism with which to address all discharges.

*Question 4.* In cleanup operations and potential harm, is there a difference between a tanker spill of refined products and crude oil?

Answer. Refined products transported by tanker range from very light gasolines to heavy bunker oil, all of which are derived from crude oil. Generally, the lighter refined products are more toxic than the heavy refined products and crude oils. The type of cleanup operation and the potential harm from any of these oils, including crude, is largely dependent on the quantity spilled, the location, time of year, weather, current and wave action and other factors. The light refined products are more harmful because they mix more easily and impact a wide range of aquatic life. The heavy refined products and crude oils make a more visible mess but are relatively less toxic and easier to recover.

*Question 5.* As you know, today's state of the art in oil and gas operations far surpasses that which existed just eight or ten years ago. With this in mind, and to put things in proper perspective, how many major oil spills that have been caused by blowouts have occurred on the OCS in the past ten years, and how many have created significant recreational or biological harm?

Answer. Our records indicate that since 1973, there have been 23 oil/gas blowouts from offshore production facilities. The record of oil spill quantity from blowouts is not accurately attainable. The Coast Guard would consider any blowout as a major incident or a potential major spill.

In our view the two most significant discharges from offshore operations were the Santa Barbara Spill and the Chevron Platform spill. Both created recreational disruption. We have reports that the Santa Barbara spill resulted in biological harm. The degree of biological harm resulting from oil spills is highly controversial, even within the scientific community.

*Question 6.* What entity actually has the responsibility to retain and clean-up crude oil spills as a result of OCS oil and gas activities? What procedures are involved, what stand-by safety measures are in effect, and what (subjective or objective) is your opinion of the record that has been established over the past seven to ten years?

Answer. The lease operator has the responsibility to retain and clean-up crude oil spills as a result of OCS oil and gas activities. The Coast Guard provides technical

review of the lease operator's oil spill contingency plan and advises the USGS on the adequacy of spill response, cleanup equipment and procedures. An MOU between USGS and the Coast Guard that will formalize this arrangement is under development. Of course, if the discharger fails to take adequate action the Coast Guard would declare a Federal action and initiate a response. It is our opinion that the industry has had a good record over the past seven to ten years.

*Question 7.* What role does the Coast Guard play in blowout clean-ups, what is the procedure, and how many times has the Coast Guard been involved in clean-up activity relating to U.S. OCS oil and gas activity over the past year? Please be specific.

Answer. In accordance with National Oil and Hazardous Substances Pollution Contingency Plan, the Coast Guard provides the On Scene Coordination (OSC), and would chair the Regional and National Response Teams. The OCS would engage those commercial and federal capabilities he judges necessary to address the discharge. This would occur only if the Coast Guard determined that the response action by the discharger was inadequate.

In 1978, the Coast Guard was involved in 52 oil discharges from OCS offshore production facilities and no oil discharges from offshore pipelines. These amounted to 0.4 percent of the total number of oil spills in the U.S. that year.

In 1979, the statistics are 21 oil discharges, and one oil discharge from the same respective categories, amounting to 0.2 percent of the total number of oil spills in the U.S.

None of these spills required significant Coast Guard response activity.

*Question 8.* In your judgment, should there be or is there anything startling about your statement concerning your inability to perform clean-up operations in greater than ten foot waves or 20-knot winds?

Answer. In our judgment, there is nothing startling about the inability to perform clean-up operations in greater than ten foot seas and 20 foot winds. As stated in the testimony, significant natural dispersion of oil takes place in 8–10 foot seas and in such conditions surface recovery operations may not be feasible, one reason being that people cannot fully or safely perform under such circumstances.

*Question 9.* Does industry have any advantage over the Coast Guard in their ability to respond to, handle, or to control oil spills resulting from blowouts?

Answer. Industry contingency planning is developed to respond to a known threat and of a narrow range of products at a specific location. The equipment can be maintained near the threatened area and logistics can be well planned ahead of time. The Coast Guard, on the other hand, is required to respond to spills over a wide area with uncertain volumes of a large range of products. In consequence, Coast Guard equipment is generally more portable, being transported in lightweight modules, covers a larger spectrum on oil and hazardous substances and is usable in a wider range of sea or environmental conditions. Transport delays can be expected and there may be times when, due to the multi purpose nature of the equipment, site specific hardware would be more effective.

*Question 10.* How many clean-up operations have actually been conducted by the Coast Guard since 1970 resulting from blowouts by U.S. OCS operators?

*Question 11.* How many clean-up operations of oil spills resulting from U.S. OCS blowouts has the Coast Guard been involved with in any capacity, and what was that capacity?

Answer. Our records indicate that there have been 23 offshore blowouts reported to the Coast Guard since 1973. The role of the Coast Guard has been to monitor the cleanup and mitigation activities performed by the parties responsible for the discharge.

*Question 12.* How many clean-up operations resulting from tanker spills has the Coast Guard been involved with since 1970? Please be specific and include products involved.

Answer. Coast Guard tanker spill data for 1973–1979 is provided in Enclosure (2).

*Question 13.* During clean-up operations, isn't it a fact that high winds and rough seas are a benefit in cleaning up a spill (such as occurred during the Bay of Campeche cleanup operations)? Isn't it also a fact that crude oil that mixes with the water column is actually broken down because of the natural events that occur when crude oil mixes with sea water?

Answer. High winds and rough seas will always hamper an operation at sea. A storm will decrease the efficiency of the operation and increase the risk to personnel. On the other hand such weather can, if carrying the oil away from an environmentally or economically sensitive area, improve the overall situation by reducing or eliminating the impact and subsequent stress of spilled oil on those areas.

Oil when released to the environment begins a biodegradation process. Some oil mixes with the water right away, but most remains as a part of the slick. It is true

that breaking waves, or whitecaps, mix the oil into the water column faster. This does not necessarily speed up the biodegradation process. In fact, when the storm subsides, much of the oil that was mixed may return to the surface. It may take years for the natural process to entirely cope with an oil spill. Even with our best efforts, impacted areas often take a long time to recover.

*Question 14.* How does our current ability to deal with an oil spill resulting from a U.S. OCS blowout relate to the U.S. record of blowouts over the past ten years?

Answer. Our current offshore response capability was discussed at length during Captain Corbett's testimony. Our projected offshore capability includes the acquisition of 26 mechanical recovery systems by the fall of 1981. Based on industry's capabilities in addition to ours, we feel the response posture for spills resulting from OCS blowouts will be rather good in 1981. We must keep in mind, however, that Coast Guard resources are used for vessel, pipeline, and other source mishaps as well as for OCS activities. Our emphasis for OCS activities is to see that the industry itself develops the capability to respond.

*Question 15.* On March 17, 1977, the President sent a message to Congress requesting that legislation be passed in order that we will be able to contain an oil spill by achieving a response time of six hours, and to handle a spill of 100,000 tons. This request was in response to the *Argo Merchant* breakup—a tanker containing refined products. How does this request relate to OCS blowouts, as compared to the more frequent and dangerous tanker spills?

Answer. The goal which the President set for the Coast Guard in his message of 17 March 1977 has been used as a planning factor in the development of Coast Guard open water response. Proposed industry response requirements for spills related to OCS activity were considered in an effort to be consistent with the response goal mentioned in the President's message.

At the time of the President's message on reducing pollution of the ocean we had no equipment which would permit the recovery of oil in seas greater than 5 feet regardless of the source. Since that time, we have modified devices for oil recovery at sea and developed techniques that would permit us to deploy these devices in up to approximately 10-foot seas. Regardless of whether the source of a discharge on open water is a tanker or an OCS blowout, the response effort would most likely involve the same equipment and techniques.

*Question 16.* During questioning, Captain Corbett stated that, "the main thrust of our activities on the OCS is not to provide Coast Guard equipment, but to insist . . . to insist that operators have the contingency plans, operating procedures, the equipment to fully respond within six hours to an oil spill on the OCS".

When was this policy instituted, and what has industry's response to that policy been?

Answer. The USGS requires planning for pollution prevention and control in their OCS Orders Governing Oil and Gas Lease Operations. These Orders were extensively revised in 1979. The recent revisions reflect the Outer Continental Shelf Lands Act Amendments of 1978 and contain requirements for the development of Oil Spill Contingency Plans. More specific equipment and operational guidelines were developed and transmitted by the Coast Guard for the consideration of the USGS Area Oil and Gas Supervisor, Region I, in March, 1980. These guidelines will be used in the review of oil spill Contingency Plans for Georges Bank.

*Question 17.* Could you please give an update on the state-of-the-art in oil spill skimmer technology? Is the Coast Guard's skimming barrier considered to be "state-of-the-art" and would it be required in an industry contingency plan?

Answer. As stated in Captain Corbett's opening remarks, the state-of-the-art for mechanical oil recovery seems to be operations in 8 to 10 foot seas and 20 knot winds. The skimming barrier in the Coast Guard's inventory has operated in these conditions. This specific device is not required in an OCS operator's equipment inventory. A device with comparable performance characteristics would be required.

*Question 18.* If a large-scale oil spill occurred near Port Angeles, Washington, what would be the probable Coast Guard response in terms of time, equipment and other Coast Guard resources?

Answer. A large-scale oil spill occurring near Port Angeles would probably require response by the Pacific Strike Team located at Hamilton AFB near San Francisco, California. We estimate it would take 4-5 hours after a request is made to have an aircraft fully loaded enroute to the nearest Port Angeles airport with a three hour flight time. This response would depend upon the availability of aircraft and weather conditions permitting flying. Containment and recovery operations would commence as soon as suitable vehicles and support vessels capable of transporting, deploying and operating the response equipment are made available and the transport executed.

*Question 19.* Captain Corbett testified that operating capability of open Ocean oil recovery equipment will likely not exceed current state-of-the-art of eight to ten foot seas and 20 knot winds, and that in addition to hazard to personnel and equipment in more severe sea states an oil spill will not remain on the ocean's surface in sufficient quantity to make mechanical clean-up feasible. Given these facts, why has the Coast Guard not advocated the use of low toxicity dispersants in such conditions such as are commonly used throughout the remainder of the world? Would not the use of dispersants as an acceptable tool increase the U.S. response capability to a satisfactory level?

Captain Corbett when discussing use of dispersants commented, "Sometimes when we disperse, we do it intentionally. That is not necessarily good. It might save Amenity Beach but it might kill a fish or two . . . " Please comment on the known effects of low toxicity dispersants on fish populations.

Answer. Until recently, there were very few low toxicity dispersants. Even now there is disagreement in the scientific community on the effects of dispersants. Our policy recognizes the fact that the situation is being clarified and that dispersants are a useful option. Of course, any dispersant use would be under the provisions of Annex X of the National Contingency Plan, a copy of which is enclosed. Also enclosed is a portion of a U.K. Ministry of Agriculture, Fisheries and Food report on research into the toxicity and control criteria of oil dispersants which we obtained from the USEPA. We suggest any further inquiries be directed to that agency which is the lead agency and has overall responsibility for the government policy on the use of dispersants.

*Question 20.* Captain Corbett stated, in effect, that oil spill clean-up equipment in the Philadelphia area is inadequate for the OCS. Was this equipment designed for OCS operations and does its presence, in fact, have any relationship to OCS operations? Is the Coast Guard aware of industry clean-up equipment dedicated to mid-Atlantic OCS operations? Is such equipment designed to operate in the OCS?

On what basis have the 11 sites for stockpiling Coast Guard clean-up equipment been chosen?

Answer. While a large number of commercial contractors and cleanup cooperatives exist in the Philadelphia area, most specialize in shore cleanup and have equipment that functions in protected waters and near shore locations. Our experiences have indicated that there is insufficient call for offshore equipment to make the large capital investment needed to maintain this capability attractive to the commercial sector unless stimulated by requirements such as those that are currently intended for activities on the Georges Bank.

We have requested from the USGS a specimen of mid-Atlantic contingency plans and will forward a copy when received.

In answer to your second question, the eleven sites were chosen on the basis of a spill risk analysis based on historical spill data. The study identified locations of expected spills and was the key to site area selection.

*Question 21.* Does the Naval Weather Service Detachment have cumulative probability distribution data on wind speeds and wave height for the Georges Bank area to support that published in the EIS for Sale 42? Is or is not the wave height less than 10 to 12 feet greater than 90 percent of the time?

Answer. The Coast Guard has no independent data to support or challenge the findings of the studies cited in the EIS concerning the sea conditions on Georges Bank. We understand that NOAA, under the supervision of the office of Environmental Data and Information Service is undertaking a "Climatological Oil Spill Planning Guide for Coastal Federal Region I" which should shed much light on this subject.

*Question 22.* What type of capability does the Coast Guard envision for responding to spills in the Gulf of Alaska resulting from OCS activities?

Answer. The Coast Guard plans to treat the Gulf of Alaska as other OCS Areas. The USGS has published OCS orders governing oil and gas operations which require the lessee to provide an oil spill contingency plan including an equipment inventory. This will greatly increase industry's capability. The Coast Guard plans to maintain pollution response equipment at our Pacific Strike Team location, presently Hamilton AFB, near San Francisco; at or near Seattle, WA and Kodiak, AK. Equipment and people from the locations would be the first to respond from Coast Guard owned resources. The Coast Guard is also coordinating our Research and Development and response efforts with those of Canadian officials.

*Question 23.* Could you explain precisely from your perspective the role of the Coast Guard, the Department of the Interior, and the industry in the development, evaluation, and approval of an oil spill contingency plan?

Answer. The USGS requires, through their OCS orders governing oil and gas lease operations, that an Oil Spill Contingency Plan be submitted by the lessee for

approval. By informal agreement the Coast Guard reviews the plans and makes comments and recommendations to USGS. This procedure is being formalized in a memorandum of understanding between the two agencies.

Coast Guard tanker spill data for 1973–1979 is provided in the following table.

## TANKERS SPILLS WITH COAST GUARD RESPONSE

| Material | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|
| Light crude: | | | | | | | |
| Number of spills | 113 | 141 | 115 | 111 | 120 | 159 | 138 |
| Total gallons | 560,264 | 1,479,199 | 2,769,983 | 497,553 | 9,674,885 | 33,024 | 910,206 |
| Sum recovered | 664,344 | 312,897 | 98,329 | 66,095 | 27,413 | 12,882 | |
| Heavy crude: | | | | | | | |
| Number of spills | 66 | 114 | 117 | 97 | 101 | 94 | 64 |
| Total gallons | 1,536,107 | 341,385 | 306,197 | 358,127 | 84,642 | 36,045 | 88,171 |
| Sum recovered | 826,569 | 314,227 | 4,664 | 76,912 | 38,894 | 15,287 | 75,325 |
| Natural gasoline: | | | | | | | |
| Number of spills | 1 | 3 | 1 | | 1 | 5 | 3 |
| Total gallons | 10 | 65 | 10 | 168 | 4,309 | 55 | |
| Sum recovered | | 60 | | | | 21 | |
| Gasoline: | | | | | | | |
| Number of spills | 24 | 44 | 31 | 39 | 44 | 48 | 37 |
| Total gallons | 55,708 | 137,373 | 855,429 | 19,090 | 80,811 | 271,773 | 400,983 |
| Sum recovered | 3,862 | 3,250 | 832,878 | 6,449 | 78,617 | 86,829 | 28,759 |
| Jet fuel: | | | | | | | |
| Number of spills | 12 | 9 | 10 | 5 | 2 | 14 | 12 |
| Total gallons | 2,163 | 567 | 1,138 | 395,848 | 6 | 669,102 | 4,633 |
| Sum recovered | 863 | 262 | 413 | 2 | | 148 | 4,249 |
| Kerosene: | | | | | | | |
| Number of spills | 7 | 4 | 5 | 1 | 6 | 5 | 3 |
| Total gallons | 527 | 77,901 | 480 | 10 | 17,507 | 2,152 | 54 |
| Sum recovered | 429 | 3,646 | 155 | 8 | 8,802 | 1,860 | 8 |
| Distillate: | | | | | | | |
| Number of spills | 10 | 19 | 15 | 13 | 11 | 9 | 12 |
| Total gallons | 1,878 | 4,693 | 36,908 | 1,042 | 1,003 | 124,835 | 2,165 |
| Sum recovered | 295 | 2,947 | 31,368 | 759 | 908 | 583 | 32 |
| Naphtha: | | | | | | | |
| Number of spills | 6 | 3 | 2 | | 4 | 1 | 5 |
| Total gallons | 335 | 109 | 25 | | 495 | 3 | 137 |
| Sum recovered | | | 3 | | 132 | | 5 |
| Mineral spirits: | | | | | | | |
| Number of spills | | | 1 | | | | 1 |
| Total gallons | | | 6 | | | | 25 |
| Sum recovered | | | 5 | | | | |
| Solvent: | | | | | | | |
| Number of spills | | 1 | 1 | | 3 | 2 | 2 |
| Total gallons | | 15 | 100 | | 1,060 | 11 | 78 |
| Sum recovered | | 14 | | | 550 | | 82 |
| Light diesel: | | | | | | | |
| Number of spills | 76 | 89 | 67 | 114 | 98 | 123 | 105 |
| Total gallons | 378,459 | 42,378 | 125,503 | 24,141 | 270,856 | 293,213 | 207,831 |
| Sum recovered | 64,430 | 13,452 | 4,410 | 16,656 | 106,331 | 11,236 | 18,870 |
| Heavy diesel: | | | | | | | |
| Number of spills | 21 | 24 | 27 | 15 | 34 | 21 | 30 |
| Total gallons | 11,200 | 3,386 | 3,684 | 1,183 | 65,987 | 56,899 | 9,883 |
| Sum recovered | 7,634 | 1,828 | 2,565 | 942 | 2,185 | 7,650 | 858 |
| Number 4 fuel oil: | | | | | | | |
| Number of spills | 27 | 37 | 23 | 18 | 20 | 13 | 10 |
| Total gallons | 2,604 | 44,836 | 131,804 | 1,419 | 22,279 | 2,874 | 122,060 |
| Sum recovered | 1,504 | 44,234 | 59,624 | 815 | 2,883 | 304 | 210 |
| Number 5 fuel oil: | | | | | | | |
| Number of spills | 6 | 5 | 9 | 10 | 8 | 12 | 8 |
| Total gallons | 5,075 | 742 | 74,470 | 85,003 | 1,000 | 10,765 | 926 |
| Sum recovered | 5,015 | 681 | 74,454 | 24,142 | 940 | 8,073 | 165 |
| Number 6 fuel oil: | | | | | | | |
| Number of spills | 225 | 233 | 181 | 186 | 216 | 255 | 229 |
| Total gallons | 117,440 | 1,058,722 | 631,665 | 9,322,897 | 941,346 | 481,074 | 450,993 |

## TANKERS SPILLS WITH COAST GUARD RESPONSE—Continued

| Material | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 |
|---|---|---|---|---|---|---|---|
| Sum recovered | 74,385 | 553,914 | 107,763 | 1,277,390 | 204,632 | 56,119 | 69,044 |
| Asphalt: | | | | | | | |
| Number of spills | 22 | 16 | 12 | 15 | 21 | 21 | 21 |
| Total gallons | 10,163 | 19,593 | 1,894 | 3,159 | 58,769 | 3,733 | 3,070 |
| Sum recovered | 8,533 | 6,169 | 1,503 | 3,621 | 56,002 | 1,944 | 1,204 |
| Coal tar: | | | | | | | |
| Number of spills | 2 | 2 | 4 | 4 | 3 | 5 | 3 |
| Total gallons | 25 | 140 | 890 | 1,125 | 25 | 83 | 71,425 |
| Sum recovered | 20 | 140 | 35 | 831 | 5 | 132 | 778 |
| Waste oil: | | | | | | | |
| Number of spills | 41 | 55 | 34 | 46 | 34 | 37 | 35 |
| Total gallons | 7,244 | 11,822 | 43,175 | 9,270 | 10,721 | 3,205 | 3,123 |
| Sum recovered | 5,832 | 4,085 | 23,278 | 6,930 | 4,074 | 1,567 | 1,627 |
| Lube oil: | | | | | | | |
| Number of spills | | 2 | | 24 | 26 | 30 | 28 |
| Total gallons | | 10 | | 1,033 | 1,015 | 1,929 | 1,446 |
| Sum recovered | | 5 | | 529 | 729 | 390 | 389 |
| LPG: | | | | | | | |
| Number of spills | 1 | | | 1 | | | |
| Total gallons | 126 | | | 1,000 | | | |
| Sum recovered | 147 | | | 1,000 | | | |
| Hydraulic fluid: | | | | | | | |
| Number of spills | 4 | 3 | 5 | 6 | 4 | 8 | 6 |
| Total gallons | 33 | 122 | 64 | 83 | 24 | 297 | 26 |
| Sum recovered | 22 | 28 | 13 | 72 | 21 | 263 | 8 |
| Laquer paint: | | | | | | | |
| Number of spills | 3 | 2 | 5 | | 2 | 1 | 4 |
| Total gallons | 3 | 11 | 1,310 | | 2 | 2 | 44 |
| Sum recovered | 2 | 1 | 1,204 | | 1 | | 39 |
| Paraffin: | | | | | | | |
| Number of spills | 1 | 4 | 1 | 1 | | | |
| Total gallons | 42 | 4,129 | 50 | | | | |
| Sum recovered | | 4,000 | 25 | | | | |
| Grease: | | | | | | | |
| Number of spills | | | | 1 | | 2 | |
| Total gallons | | | | 2 | | | |
| Sum recovered | | | | 1 | | | |
| Mixed petroleum: | | | | | | | |
| Number of spills | 17 | 14 | 15 | 8 | 17 | 23 | 23 |
| Total gallons | 1,436 | 4,300 | 7,204 | 643 | 9,364 | 41,699 | 892 |
| Sum recovered | 1,823 | 3,252 | 1,652 | 501 | 848 | 192 | 500 |
| Oil based pesticides: | | | | | | | |
| Number of spills | 1 | 1 | 1 | | | | |
| Total gallons | 6 | 84 | 210 | | | | |
| Sum recovered | 6 | | | | | | |
| Unidentified light oil: | | | | | | | |
| Number of spills | 12 | 11 | 8 | 7 | 12 | 9 | 18 |
| Total gallons | 820 | 1,697 | 490 | 5,155 | 1,001 | 1,732 | 132 |
| Sum recovered | 794 | 1,656 | 223 | 5,122 | 126 | 471 | 20 |
| Unidentified heavy oil: | | | | | | | |
| Number of spills | 16 | 17 | 11 | 17 | 9 | 11 | 7 |
| Total gallons | 5,407 | 2,044 | 31,289 | 968 | 341 | 7,497 | 1,823 |
| Sum recovered | 2,244 | 1,749 | 31,097 | 480 | 223 | 244 | 1,500 |
| Other oil: | | | | | | | |
| Number of spills | 52 | 55 | 37 | 26 | 30 | 31 | 35 |
| Total gallons | 4,482 | 5,740 | 3,825 | 1,892 | 4,057 | 1,225 | 843,130 |
| Sum recovered | 2,525 | 1,866 | 1,091 | 1,981 | 4,953 | 573 | 1,589 |

federal register

Wednesday
March 19, 1980

Part III

# Council on Environmental Quality

National Oil and Hazardous Substances Pollution Contingency Plan; Final Revision

ENCLOSURE(2)

**COUNCIL ON ENVIRONMENTAL QUALITY**

**40 CFR Part 1510**

**National Oil and Hazardous Substances Pollution Contingency Plan; Final Revision**

**AGENCY:** Council on Environmental Quality, Executive Office of the President.

**ACTION:** Final Revision of National Contingency Plan.

**SUMMARY:** These final revisions to the National Oil and Hazardous Substances Pollution Contingency Plan update the Plan to conform to the Clean Water Act amendments of 1977 and restructure the Plan to eliminate duplication and simplify reading. Substantive changes include: (1) Increasing State participation in the Plan, (2) provision for the preparation of local contingency plans, (3) incorporation of the National Pollution Equipment Inventory System, (4) provision for Scientific Support Coordinators, (5) provision for periodic field testing, and (6) clarification of the application of the Endangered Species Act. These changes are designed to improve the efficiency, coordination and effectiveness with which Federal agencies respond to discharges or substantial threats of discharges of oil and hazardous substances.

**EFFECTIVE DATE:** March 19, 1980.

**FOR FURTHER INFORMATION CONTACT:** Foster Knight, Counsel, Council on Environmental Quality, 722 Jackson Place, N.W., Washington, D.C. 20006, (202) 395-5750, or Richard Hess, EPA-Coast Guard Liaison, Headquarters, U.S. Coast Guard, G-WEP/73, Washington, D.C. 20590 (202) 426-9571.

**SUPPLEMENTARY INFORMATION:**

**A. Purpose**

We are publishing final revisions to the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR 1510 (as amended March 26, 1976). The Plan is the basis for Federal action to minimize pollution damage from discharges of oil or hazardous substances. The purpose of these revisions is to update the Plan and improve the efficiency, coordination, and effectiveness with which Federal agencies respond to a discharge or substantial threat of discharge of oil or a hazardous substance. We expect the revised regulations to improve planning by and coordination among State and Federal agencies, to improve assessment of environmental damage from spills and to facilitate evaluation of response effectiveness.

**B. Summary of Changes Made by the Final Revisions.**

1. *Changes to make the Plan track with the Clean Water Act amendments of 1977.*—See particularly §§ 1510.3, 1510.21. Following the Clean Water Act amendments of 1977, the regulations modify the scope of the Plan (§ 1510.3) to include the expanded economic zone of the Fishery Conservation and Management Act of 1976. The revisions apply the Plan to potential as well as actual discharges (§ 1510.21(b)).

2. *Increasing the role of state participation in the Plan.*—(a) States are invited to participate as full members of Regional Response Teams (RRTs). Full participation of high level state representation is desired. See § 1510.23(a) and § 1510.34 (a) and (f).

(b) Section 1510.23(b). EPA and the U.S. Coast Guard should explore the possibility of entering into agreements with states which will delegate to the state spill cleanup responsibilities.

(c) Section 1510.34 (m), (n) and (o). Provisions for RRT members (including state members) to appeal decisions of the RRT to the National Response Team (NRT) and to request further review by CEQ.

3. *Local Contingency Plans.*—The revised Plan makes provision for local contingency plans for dealing with spills in ports or local areas.

Sections 1510.36(d) and 1510.42 provide that the On-Scene Coordinator (OSC) is responsible for developing and maintaining a local contingency plan for the OSC's area of responsibility. Local plans must identify: (1) Environmentally sensitive areas, (2) most probable locations for pollution incidents, (3) the kinds of resources that would be needed to respond to spill incidents, (4) where such resources can be obtained, (5) plans of action for protecting vulnerable resources, (6) sites for disposing recovered oil and hazardous substances, and (7) a local organizational structure for spill response.

To aid the development of local contingency plans, § 1510.34(d) provides that RRTs must designate members to assist the OSC in local contingency planning.

4. *National Pollution Equipment Inventory System.*—The revised Plan in § 1510.43 incorporates a national inventory of equipment and resources available for oil and hazardous substance spill response.

5. *Scientific Support Coordinators.*—The revised Plan provides a mechanism for coordination between the On-Scene Coordinator (OSC) and the scientific community during spills. Such a mechanism is necessary in order to provide the OSC with sound scientific advice in an orderly way, so that the OSC does not have to devote scarce time to a number of different scientists who are concerned about providing cleanup advice and conducting experiments during spill cleanup operations.

Section 1510.64(c) establishes a scientific support organization headed by Scientific Support Coordinators (SSCs) who are designated by EPA for inland spills and by NOAA for coastal area spills.

6. *Annual Field Exercises.*—The revised Plan makes provision for periodic field testing by the RRTs of their spill response equipment and people.

Section 1510.34(h) requires each coastal RRT to conduct annual training exercises in which equipment is actually deployed.

Section 1510.34(i) strongly encourages each inland RRT to conduct annual training exercises.

7. *Changes Reflecting Requirements of the Endangered Species Act.*—The revised Plan specifically discusses the relationship between spill response and cleanup actions and the requirements of legislation protecting endangered or threatened species.

Section 1510.36(a)(3) provides that advice to the OSC provided by DOI through the Fish and Wildlife Service or by Commerce through the National Marine Fisheries Service on the cleanup of spills that affect endangered species, shall be binding on the OSC (with specified exceptions).

8. *Public Information.*—The previous Plan provided for dissemination of public information in Annex VI.

The revised Plan moves the provisions of Annex VI to new § 1510.37. In addition, changes are made to make the Plan conform to the existing public information network.

9. *Restructuring Plan for Easier Reading.*—The previous Plan contained considerable useful information buried in its Annexes.

The revised Plan shifts this more important material into the body of the Plan. The revisions also add new Annex material (new Annexes II, VI and VIII). See attached comparison of Previous Plan and Revised Plan.

In addition, the revisions eliminate duplicative material and rewrite some provisions to achieve clarity and to make minor corrections of outdated Plan information.

| Previous Plan | Revised Plan |
|---|---|
| Annex I (Distribution) | Remains the same. |
| Annex II (N.R.T. functions) | NRT functions are in § 1510.32.* (Annex II—Formats For Regional and Local Contingency Plans.) |
| Annex III (National Response Center functions). | NRC functions are in § 1510.33. (Annex III—Regions and Office Locations of Agencies.) |
| Annex IV (Office Locations of Primary Agencies). | Office locations are in Annex III. (Annex IV—Legal Authorities.) |
| Annex V (Communication and Reports). | Reports are in § 1510.56.* (Annex V—Communication Services Available.) |
| Annex VI (Public Information). | Public information is in § 1510.37* (Annex VI—Sample Collection Procedures to be followed by OSCs.) |
| Annex VII (Legal Authorities) | Legal Authorities are in Annex IV. (Annex VII—Technical Library.) |
| Annex VIII (Documentation and Cost Recovery). | Documentation and Cost Recovery are in § 1510.55. (Annex VIII—Definition of Technical Terms.) |
| Annex IX (Funding) | Funding is in § 1510.65. Annex IX (blank). |
| Annex X (Schedule of Chemicals and Additives For Removal of Oil and Hazardous Substances). | Remains the same. |
| Annex XI (Non-Federal Interests). | Non-Federal Interests are in § 1510.23. |
| Annex XII (blank) | |
| Annex XIII (blank) | |
| Annex XIV (blank) | |
| Annex XV (Technical Library and Definitions of Technical Terms). | Technical Library is in Annex VII; Definition of Technical Terms is in Annex VIII. |

*Denotes new annex material.

## C. Background

The Plan was first published as an interagency agreement in 1968. It became part of the Code of Federal Regulations in 1970 in accordance with the Water Quality Improvement Act of 1970. Section 311(c)(2) of the Clean Water Act gives the President the responsibility for issuing the Plan. By Executive Order 11735 (August, 1973), this responsibility was delegated to the Council on Environmental Quality (CEQ). In 1973 the Plan was published in its current format. The version that is being revised by these final regulations was publish in 1975 with some minor changes incorporated in 1976.

A number of events over the past two years have identified opportunities for improving the Plan. In late December 1976, the *Argo Merchant* ran aground on Nantucket Shoals, 27 miles from Nantucket Island, Massachusetts. The resulting spill of 7.5 million gallons of oil led to a massive spill response action under the National Contingency Plan. Although the weather conditions exceeded technological capabilities for recovery of the oil, those same conditions meant that no oil reached the Massachusetts shoreline. In April 1978, Massachusetts submitted a Petition for Rulemaking to revise the Plan, asking for specific changes. In addition, a spill of 250,000 gallons earlier in the year resulted in massive shoreline damage on the Chesapeake Bay as 27 miles of coastline were contaminated by the oil.

On June 3, 1979 the worst oil spill in history began with the blow-out of IXTOC No. 1, a well being drilled in the Bay of Campeche by PEMEX, Mexico's national oil company. Estimates of the oil spilled ranged from 10,000 to 30,000 barrels per day. Efforts to plug the well were unsuccessful and drilling of two relief wells began. By late July, 1979 cleanup efforts were only partially successful at best despite the efforts of Mexican authorities, the U.S. Coast Guard's Open Water Containment Recovery System and cleanup firms from around the world. Towards the end of the summer of 1979 huge oil slicks moved north and threatened the Texas coast. The U.S. Coast Guard and Texas authorities prepared to try to protect the highly productive estuaries behind the string of barrier islands on the south Texas coast and to mitigate damage to beaches and the tourist industry. Oil from the spill ultimately reached the south Texas coastline affecting a large geographical area and a multitude of local and regional interests. Response efforts however were moderately successful in mitigating damage.

As a result of such incidents and continuing United States dependency on oil imported by tanker, attention from various levels of government has been continually focused on the response capabilities of the federal government.

Congressional subcommittees have investigated both the response to specific incidents and the general federal scheme for coordinated action. In response to these events and as part of its responsibility to recommend changes, proposed revisions have been submitted to CEQ by the national Response Team, the national group of federal agencies responsible for planning and coordination under this Plan.

Some problems were also addressed in the Clean Water Act amendments of 1977 (Pub. L. No. 95–217 amending 33 U.S.C. 1251 *et seq.*) which changed the jurisdiction of the Plan. The revision of the Plan reflects these statutory changes.

The revised Plan also addresses other problems noted in the course of response actions. In October 1977, CEQ requested information from the States on problems they had encountered in activities under the Plan. Twenty-seven states responded, generally expressing satisfaction with the Plan but offering suggestions for improvements.

The Council published proposed revisions to the National Contingency Plan on May 14, 1979 (44 FR 28196) with 60 days for public review and comment. This comment period was extended upon request until September 1, 1979. The Council received comments from the oil industry, independent waterways operators, state, regional, and local governments and miscellaneous interested parties, totalling 29 written comments. In addition the regional offices of the principal federal agencies provided a number of technical comments.

The Council's staff read and analyzed each of the comments received and developed recommendations were then presented to the National Response Team for further evaluation and recommendations. Finally comments raising significant issues together with staff and National Response Team recommendations for appropriate changes were presented to the Council for resolution.

When, after discussions and review the Council determined that the comments raised valid concerns, the Plan regulations were modified to reflect those concerns. When the Council determined that reasons supporting the Plan provisions were stronger than those for changing them, the Plan provisions were left unchanged. Part D of the Preamble describes the more significant comments received and how the Council responded to them.

## D. Comments and the Council's Response

### *Comments on Section 1510.5—Definitions*

One comment objected to the definition of "oil" in § 1510.5, to the extent it includes oil in combination with other substances, as being too vague and imprecise. The Council however determined not to change the definition as it repeats verbatim the definition of "oil" in § 311(a)(1) of the Clean Water Act.

Several comments were critical of § 1510.5(r)(1)'s definition of a minor discharge of a hazardous substance as "a quantity less than that defined as reportable by regulation (40 CFR Part 117)." The comments expressed concern that this definition was inconsistent with EPA's hazardous spills regulations where the enumerated substances are considered hazardous if a quantity equal to or greater than the "reportable quantity" is spilled. The purpose of the Plan is to provide for removal of oil and hazardous substances even in cases where no liability attaches to the discharger. There are many instances where the quantity of hazardous substances spilled cannot be accurately

determined. A definition of minor discharge which excludes less than reportable quantities will discourage efforts to remove such spills. For these reasons, the Council determined not to change the definition of minor discharge of hazardous substances.

The comments also recommended establishing a practical lower limit in the definition of a minor oil spill such as California's 10 gallon limit. The Council determined however that the existing definition in § 1510.5(r)(1), "less than 1000 gallons", is working well and should not be changed.

*Comments on Section 1510.21—Federal Responsibility*

Some comments pointed out that the proposed language for § 1510.21(a) did not adequately reflect § 311(c)(1) of the Clean Water Act by omitting the modifier "substantial" before "threat." Section 311(c)(1) specifies Federal response actions where there are discharges or a "substantial threat" of such discharge. The Council agrees with these comments. Since this problem was presented in other parts of the proposed revisions, the Council is correcting it by changing the definition of "potential discharge," in § 1510.5(n), to mean "any accident or other circumstance which constitutes a substantial threat of a discharge of oil or hazardous substance." Thus, subject to § 311(c)(1), Federal responsibility exists for discharges and potential discharges. These changes address these same comments with respect to §§ 1510.21(b), 1510.53(a), and 1510.63(b).

*Comments on Section 1510.36(b)—On-Scene Coordinator*

A number of companies and organizations involved in the carriage of bulk petroleum and chemicals in inland waters requested that § 1510.36(b) be changed to provide that the U.S. Coast Guard (rather than the Environmental Protection Agency) furnish or provide the On-Scene Coordinator for all navigable waters of the United States which are used by waterborne commerce. The principal reasons given in support of this change are: (1) that the Coast Guard is already required to be involved in inland waterway discharges in order to evaluate compliance with pollution prevention regulations and to evaluate penalty assessments, and (2) that it would be an unnecessary duplication of federal agency resources to have the EPA act as On-Scene Coordinator for inland waterway spills. Furthermore EPA's capability to act quickly as the On-Scene Coordinator was questioned by some commenters.

The National Response Team which has overall operational and implementing responsibility for the National Contingency Plan recommended that § 1510.36(b) not be changed because in certain inland waterway regions EPA provides the most effective On-Scene Coordinator, while in others (where the Coast Guard is the most effective), EPA normally predesignates the Coast Guard to serve as the inland waterway OCS. The National Response Team therefore recommended that the existing flexibility in allowing both the EPA and the Coast Guard to be On-Scene Coordinators for inland waterways (depending on the circumstances) is preferable to a fixed rule assigning only the Coast Guard to that function. Based on the National Response Team's experience and recommendations, the Council therefore determined to leave § 1510.36(b) unchanged.

Some commenters expressed concern that the proposed revisions to the Plan (particularly § 1510.36(a)(3) with respect to compliance with the Endangered Species Act and with respect to the use of chemical dispersants governed by Annex X) diminished the On-Scene Coordinator's authority and effectiveness to respond quickly to a spill. These commenters requested that § 1510.36(a)(3) and Annex X be changed to eliminate restrictions on the OSC's authority.

Section 1510.36(a)(3) provides that advice to the On-Scene Coordinator provided by the Fish and Wildlife Service (Department of the Interior) or by the National Marine Fisheries Service (Department of Commerce) on cleanup actions that may affect endangered species shall be considered at all times and be binding on the On-Scene Coordinator unless in the OSC's judgment contrary actions must be taken to protect human life. The Council does not regard this provision as a new limitation on the OSC's authority to act but rather as an incorporation of the requirements of the Endangered Species Act which, since 1973, has applied to all activities of federal agencies and responsible federal officials. In essence, this provision is designed to assist the OSC to comply with the Endangered Species Act, through the expertise of the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS), in circumstances where cleanup actions may affect endangered species. Whenever the OSC determines that certain actions must be taken to protect human life, the OSC's judgment will prevail over FWS or NMFS advice to the contrary. For these reasons the Council determined to leave this part of § 1510.36(a)(3) unchanged. Annex X is modified to include a cross-reference to § 1510.36(a)(3). These changes do not affect the OSC's authority to use chemical dispersants such as to substantially reduce explosion or fire hazards to property where there is no threat to endangered species.

With respect to the use of chemical dispersants covered by Annex X, several commenters recommended that the On-Scene Coordinator be provided with authority to allow the spiller or his agents to use *registered chemical dispersants* in *offshore areas* for protection of sensitive environmental or commercial fishery areas without the concurrence of the EPA representative on the Regional Response Team. The National Response Team carefully considered this request but concluded that the continuing involvement of EPA representatives before use of chemical dispersants outweighs any benefits to be derived by allowing the spiller to use dispersants in such areas without advance EPA concurrence. The Council adopted the National Response Team's recommendation with respect to this issue. However, it is the intent of the Plan that the EPA Regional Response Team member continue to work closely with the Coast Guard On-Scene Coordinators to provide greater guidance—in advance of spills—on the circumstances that justify use of chemical dispersants.

Several commenters felt that the priorities of the Plan were insufficiently spelled out and recommended that the primary goals of a spill response be (1) to protect human life and limb and (2) to minimize ecological impacts of spills. The National Response Team believes that these priorities are inherent in the Plan and are already covered in § 1510.36(a)(3) and Annex X. The Council agrees with the NRT and that On-Scene Coordinators have adequate explicit guidance on these priorities.

One comment recommended that § 1510.36(a)(1) be clarified to provide that the first official from an agency with responsibility under the Plan to arrive at the scene of a discharge is to function as acting OSC (if other than the predesignated OSC) until the OSC arrives. The NRT determined that § 1510.36(a)(1) already is sufficiently clear on this point by providing that the first official to arrive on scene "shall coordinate activities under the plan until the OSC arrives." "Shall coordinate activities" includes authority to act as OSC.

*Comments on Section 1510.37—Public Information Network*

Several comments expressed concern that proposed § 1510.37(b) establishes a regional news office as the "single source of official information on the incident", to the detriment of the public interest in obtaining information from public agencies and private interests. Section 1510.37 has been substantially rewritten, and eliminates the regional news office as the single source of official federal information. As rewritten § 1510.37 provides for coordination of news releases through the OSC, through an on-scene news office or a national news office. Participating federal agencies are given a larger role in the public information network. At the same time, information from private interests on a pollution incident remains unaffected by § 1510.37 or any other provision in the Plan, because the Plan cannot regulate the manner or content of information on a pollution incident provided by private interests. To provide for greater coordination with local government a new sentence is added to § 1510.37(a)(1): [When a major pollution incident occurs] "Those immediately capable, especially local fire, police and government officials, will be contacted first so that they may use all available resources to notify the public of a potential threat."

*Comments on Section 1510.42—Local Contingency Plans*

One comment recommended that local contingency plans also include development of methods for protecting environmentally sensitive areas. This is addressed in § 1510.42(a) (plans of action for protecting vulnerable resources).

*Comments on Section 1510.43—National Inventory System*

One comment suggested that standard indemnification agreements be entered into between the Federal government and private parties whose cleanup equipment is listed in the inventory such that owners will be indemnified for any damage that may occur when the equipment is used at the direction of the On-Scene Coordinator. The NRT recommended that indemnification for damaged private equipment need not be addressed in the Plan because private equipment used by the OSC is obtained through rental or other contractual agreements which contain adequate indemnification provisions. The Council therefore deferred to the expertise of the NRT on this issue.

*Comments on Section 1510.63—General Pattern of Response Actions*

One comment objected to the sentence in § 1510.63(a)(3)(i) which provides "The discharger's removal efforts are 'improper' to the extent that Federal efforts are necessary to prevent further damage." The comment expressed concern that this language prevents or discourages a discharger from seeking Federal removal assistance where Federal assistance would speed the discharger's otherwise "proper" removal actions. The comment misconstrues § 1510.63(a)(3)(i). That section does not mean that otherwise "proper" removal actions by the discharged are rendered improper simply because the discharger seeks Federal assistance.

*Comments on Section 1510.64—Special Forces*

Several comments were received concerning this section. The State of Washington felt that this section duplicated and conflicted with its own oil and hazardous spills contingency plan provisions governing marine resources damage assessment. Section 1510.64 has been substantially revised based on NRT recommendations and the comments received. With respect to the State of Washington's comment, § 1510.64(c)(2)(i)(aa) makes it clear that well developed state scientific support organizations like Washington's should be employed to support the OSC. Section 1510.64 is not to be construed as requiring the development of duplicatory federal scientific support coordinators where an effective state scientific support organization can be utilized to support the OSC, as coordinated by the state representative on the Regional Response Team.

One commenter recommended changing the title of Scientific Support Coordinator to Scientific Support Advisor. However the NRT believes that Scientific Support Coordinator more accurately reflects the role of the scientific support organization which involves advice to the OSC and RRT but is primarily a coordination role. For this reason the title was not changed.

Another comment recommended that the discharger be advised of the scope of studies to be undertaken by the scientific support organization and be offered an opportunity to comment on its potential liability. The Plan recognizes, as the comment points out, that the line between damage assessment studies (where there may be liability) and pure research (where there is no liability) is difficult to draw. However this problem is addressed in revised §§ 1510.65 (b) and (c) which make it clear that the OSC is to exercise sufficient control over removal operations (including damage assessment) to be able to certify that reimbursement is appropriate.

Concern has also expressed that proposed § 1510.64(c)(1) "would seemingly exclude contractual agreements with commercial environmental firms" to provide scientific assistance and damage assessment for the OSC. This was not the intent, and § 1510.64(c)(2)(i)(aa), as rewritten, expressly includes industry.

*Comments on Section 1510.65—Funding*

Several comments were received critical of the proposed language in § 1510.65(c). The concern expressed by these comments was that the proposed language implied that the OSC would not be requesting services and resources where essential to an effective Federal response. The Council agrees that the indicated language in proposed § 1510.65(c) was inappropriate. Therefore the last three sentences in proposed § 1510.65(c) were removed and conforming changes were made to the last sentences in § 1510.65(b) and 1510.65(c).

*Other Comments*

The Commonwealth of Massachusetts urged that the Plan provide for the financial capability of the participating agencies in carrying out the Plan, through an annual assessment of funds available to each agency. The Plan is not authorized to require annual assessments. In response to this comment, however, § 1510.65 relating to funding has been changed to clarify each agency's funding authority and responsibility. Massachusetts also indicated that proposed § 1510.64(c) providing for scientific support coordinators from both EPA and NOAA was a costly redundancy. Section 1510.64(c) has been modified but still preserves the SSC role for EPA in inland waters and for NOAA in coastal waters because the NRT determined this allocation of agency expertise would be the most effective.

The New England Congressional Caucus recommended provision in the Plan for requiring spill cleanup equipment to be stationed near areas of probable spills. The NRT recommended that rather than stationing equipment the most efficient approach is to maintain an up-to-date national inventory and to provide in local contingency plans for the identification of types and locations of clean-up equipment and resources. The Council adopted the NRT recommendation. The

Caucus also recommended that the Atlantic Strike Team be redeployed to an area to the northeast of its present location. Deployment decisions are within the jurisdiction of the U.S. Coast Guard. The Council has therefore referred this recommendation to the U.S. Coast Guard.

The International Association of Fire Chiefs expressed concern that the Plan unduly and excessively interfered with local agency authority to control and supervise spill response efforts, particularly with respect to responses by local fire and civil defense officials. A number of changes were made in response to this criticism in order to highlight the importance of coordination with local officials and to emphasize that the Plan covers only the Federal response. See §§1510.23(a), 1510.34(f), 1510.36(d), 1510.37(a)(1) and 1510.42(a). Concern was also expressed that §1510.57(a) authorizes the OSC to keep the fire chief and civil defense officials out of the affected area. That section is not intended to give the OSC such authority. Local contingency plans, particularly with the cooperation of local fire and civil defense officials, are to be developed in a manner consistent with local fire and disaster plans and requirements. See §1510.42(a).

One comment recommended expansion and clarification of the Plan concerning the relationship between a responsible discharger (a discharger who is taking proper action to clean up the spill) and the Federal government. The comment recommended coverage of at least four points which are listed below with responses:

(1) What is the continuing role of the OSC if the discharger is in charge of the clean up operation? This question is addressed by §§1510.21(a) and 1510.52(c) which provides that the OSC has a continuing responsibility to monitor clean up actions being taken by the discharger and to provide advice.

(2) Does the OSC continue as the government spokesman for all levels of government? This is addressed in the affirmative by §§1510.5(k) (definition of OSC), 1510.21(a) and Section 1510.52(c).

(3) How is government support and assistance obtained by the discharger (e.g. scientific support)? This is addressed by §§1510.52(c), 1510.63(a)(3), 1510.63(b)(3)(ii) and 1510.64. The OSC's monitoring and surveillance duties includes providing advice and assistance to dischargers concerning proper cleanup and removal actions. Dischargers are encouraged to seek scientific support advice through the OSC on matters not already covered by this Plan and annexes, and the applicable regional and local contingency plans.

(4) How are relations with the news media and public handled? Section 1510.37 provides for relations with the news media and for public information where there is a Federal response to a spill under the Plan. The Plan, of course, cannot govern the manner or content of information provided by the discharger. Where the discharger retains control of the cleanup and removal actions, the public information and news media provisions in §1510.37 will not apply; they only apply where a Federal response is initiated under this Plan.

For the reasons given above, and because the NRT does not believe any significant problems exist in the relationship between the discharger and the Federal government that are not already addressed in the Plan, the NRT recommended that no additional provisions be added to the Plan concerning these points. The Council deferred to the NRT's recommendations.

Several comments from the oil industry recommended that the Plan require the RRT to send copies of their activity reports (under §1510.34(g)(9)) to the oil industry. These reports are available to the public; the American Petroleum Institute representative attending NRT meetings as an observer will be able to obtain copies of such reports and provide for appropriate distribution to the oil industry.

One comment recommended deletion of the term "Coker Feed" in Annex VIII as being inaccurate. This recommendation was adopted.

**E. Additional Changes Based on Federal Interagency Comments and NRT Recommendations**

Following publication of the proposed revisions to the National Contingency Plan federal agency review resulted in a number of additional changes of essentially a clarifying nature. These are summarized below.

The distinction between Federal primary and advisory agencies under the Plan has been eliminated since over a period of time it has become meaningless. All Federal agencies under the Plan are now referred to as participating agencies. See §§1510.5, 1510.22, 1510.32.

Provisions governing referrals and appeals of decisions by the Regional Response Teams have been clarified. See §§1510.2(10), 1510.32 (m) and (n).

Descriptions of Federal agency expertise and roles under the Plan have been further updated. See §§1510.4, 1510.22(b), 1510.64(c), and Annex III.

Section 1510.37 concerning the public information network has been substantially revised both in response to public comments and to incorporate experience gained by the NRT during 1979 concerning the Campeche Bay and other oil spills affecting U.S. waters in the Gulf of Mexico.

Section 1510.64 relating to Special Forces has been revised in response to public comments and NRT recommendations, particularly with respect to clarifying the responsibilities of NOAA, EPA and the Department of the Interior (Fish and Wildlife Service) in providing scientific support.

**F. Regulatory Analyses**

Because the Plan governs the Federal government's response to oil and hazardous substances pollution and does not regulate private activities, and since the revisions to the Plan are primarily of a simplifying and updating nature, the Council, supported by a recommendation from the NRT, determined that a regulatory analysis under E.O. 12044 was not required in conjunction with the publication of the Final revisions. The final revisions to the National Contingency Plan implement the policy and other requirements of Executive Order 12044 (Improving Government Regulations) to the fullest extent possible. The revised Plan has been simplified and substantially rewritten in plain language. In reviewing the proposed revisions the Council gave careful attention to minimizing any burden on the public.

The determinations required by Section 2(d) of the Order have been made by the Council and are available on request.

**G. Conclusion**

We could not, of course, adopt every suggestion that was made on revisions to the National Contingency Plan. We have tried to respond to the major concerns that were expressed. We are confident that any issues which arise in the future can be resolved through recommendations by the public, state and local governments and the participating agencies to the Regional Response Teams and the National Response Team. The National Response Team will continue to supervise implementation of the Plan and, where appropriate, make recommendations to the Council for additional revisions.

We appreciate the efforts of the many people who participated in developing and refining the revisions to the Plan.

**Gus Speth,**

*Chairman.*

Part 1510 is revised to read as set forth below:

# PART 1510—NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN

## Subpart A—Introduction

Sec.



## Subpart B—Policy and Responsibility



## Subpart C—Organization



## Subpart D—Plans



## Subpart E—Operational-Response Phases



## Subpart F—Coordinating Instructions



### List of Annexes



**Authority:** Sec. 311(c)(2), Pub. L. 92-500, as amended; 86 Stat. 865, 33 U.S.C. 1321(c)(2); Executive Order 11735, 38 FR 21243 (August 1973).

## Subpart A—Introduction

### § 1510.1 Purpose and objectives.

This National Oil and Hazardous Substances Pollution Contingency Plan provides for coordinated Federal action to try to prevent discharges of oil and hazardous substances, and to protect the environment from damage when discharges occur. The Plan also promotes Federal-State coordination and encourages local governments and private firms to build capabilities for cleaning up discharges.

### § 1510.2 Authority.

This Plan was developed in compliance with Section 311(c)(2) of the Clean Water Act, as amended (33 U.S.C. 1321(c)(2)). In Executive Order 11735, the President delegated to the Council on Environmental Quality authority and responsibility to prepare, publish, revise, and amend a National Contingency Plan for the removal of oil and hazardous substances.

(b) The Plan and its Annexes, and regional and local plans, provide for:

(1) Assignment of responsibilities among Federal agencies, in coordination with State and local agencies;

(2) Identification, procurement, maintenance, and storage of equipment and supplies;

(3) Establishment or designation of

(i) A strike force to carry out the Plan and

(ii) Trained and adequately equipped emergency task forces at major ports;

(4) A system of surveillance and reporting to give responsible Federal and State agencies the earliest possible notice of discharges of oil and hazardous substances or imminent threats of such discharges.

(5) Establishment of a national center to provide for coordination and direction of operations in carrying out the Plan;

(6) Procedures for identifying, containing, dispersing, and removing oil and hazardous substances;

(7) A schedule, prepared in cooperation with the states, identifying any dispersants or other chemicals that may be used in carrying out the Plan;

(8) A system for reimbursing states for reasonable costs incurred in removing discharges;

(9) A procedure for coordinating scientific support of cleanup operations, assessment of damage after a spill, and research efforts; and

(10) A system for referral and appeal of decisions of the Regional Response Teams and On-Scene Coordinators.

### § 1510.3 Scope.

(a) The Plan applies to all Federal agencies and is in effect for the navigable waters of the United States and adjoining shorelines, for the contiguous zone, and the high seas beyond the contiguous zone in connection with activities under the Outer Continental Shelf Lands Act or the Deep Water Port Act of 1974, or which may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States (including resources under the Fishery Conservation and Management Act of 1976). (See Sections 311(b)(1) and 502(7) of the Clean Water Act).

(b) Implementation of this Plan is complementary to the Joint U.S./Canadian Contingency Plan (including the annexes pertaining to the Great Lakes, and the Eastern and Western coastal areas); the Joint U.S./Mexican Contingency Plan (when adopted by both parties); and international assistance plans and agreements, security regulations, and responsibilities based upon Federal statutes and Executive Orders. This Plan shall be utilized to coordinate U.S. involvement in pollution incidents occurring in waters not under the management jurisdiction of the United States.

### § 1510.4 Abbreviations.

(a) *Department and Agency title abbreviations:*

CEQ—Council on Environmental Quality.
Corps—U.S. Army Corps of Engineers.
DHEW—Department of Health, Education, and Welfare.
DOC—Department of Commerce.
DOD—Department of Defense.
DOE—Department of Energy.
DOI—Department of the Interior.
DOJ—Department of Justice.
DOL—Department of Labor.
DOS—Department of State.
DOT—Department of Transportation.
EPA—Environmental Protection Agency.
FEMA—Federal Emergency Management Agency.
FWS—U.S. Fish and Wildlife Service.
MarAd—Maritime Administration.
NMFS—National Marine Fisheries Service.
NOAA—National Oceanic and Atmospheric Administration.
USCG—U.S. Coast Guard.
USDA—Department of Agriculture.
USGS—U.S. Geological Survey.
USN—U.S. Navy.

(b) *Operational title abbreviations:*

ERT—Environmental Response Team.
NRC—National Response Center.
NRT—National Response Team.

OSC—On-Scene Coordinator.
PIAT—Public Information Assistance Team.
SSC—Scientific Support Coordinator.
RRC—Regional Response Center.
RRT—Regional Response Team.

**§ 1510.5 Definitions.**

(a) Act—means the Clean Water Act, as amended, 33 U.S.C. 1251, *et seq.*

(b) Activation—means notification by telephone or other expeditious means to the appropriate state and local officials, to the regional or district office of participating agencies, or, when required, the assembly of some or all members of the RRT or the NRT.

(c) Coastal waters—generally means U.S. waters which are navigable by deep draft vessels, including the contiguous zone and parts of the high seas to which this Plan is applicable and other waters subject to tidal influence.

(d) Contiguous Zone—means the zone of the high seas, established by the United States under Article 24 of the Convention on the Territorial Sea and the Contiguous Zone, which is contiguous to the territorial sea and which extends 12 miles seaward from the same baseline from which the territorial sea is measured.

(e) Discharge—includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying or dumping of oil or hazardous substances. Discharges permitted under Section 301, 302, 306, 318, 402 or 404 of the Act or Section 102 of the Marine Protection, Research and Sanctuaries Act of 1972 (Pub. L. No. 92-532) are not included.

(f) Hazardous substance—means any substance designated as hazardous under subsection (b)(2) of section 311 of the Act (see 40 CFR Part 116).

(g) Inland waters—generally means U.S. waters upstream from coastal waters.

(h) Major disaster—means any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, drought, fire or other catastrophe in the United States which the President determines to be damaging enough to warrant major disaster assistance under the Disaster Relief Act of 1974 (Pub. L. 93-288).

(i) Presidential Emergency Determination—a formal Presidential decision made at the request of a State Governor determining that a situation constitutes an "emergency" in accordance with the provisions of the Disaster Relief Act of 1974 (Pub. L. 93-288).

(j) Oil—means oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, sludge, oil refuse and oil mixed with wastes other than dredged spoil.

(k) On-Scene Coordinator (OSC)—means the Federal official predesignated by the EPA or the USCG to coordinate and direct the Federal response to spills, and discharge removal efforts at the scene of a discharge.

(l) Phases—response actions fall into five classes or phases. Phase I is Discovery and Notification; Phase II, Evaluation and Initiation of Action; Phase III, Containment and Countermeasures; Phase IV, Removal, Mitigation and Disposal; and Phase V, Documentation and Cost Recovery. Elements of any phase may coincide with other phases. For a full description of the phases, see Subpart E, § 1510.51-55.

(m) Plan—means the National Oil and Hazardous Substances Pollution Contingency Plan.

(n) Potential discharge—means any accident or other circumstance which constitutes a substantial threat of a discharge of oil or hazardous substance. Severity of potential discharges shall be classified according to the guidelines in subparagraph (r) below.

(o) Participating agencies—means all departments and agencies on the NRT that have responsibility and provide resources for the effective operation of this Plan.

(p) Public health or welfare—includes all factors affecting human health and welfare, including, but not limited to, human health, the natural environment, fish, shellfish, wildlife, and public and private property, shorelines and beaches.

(q) Remove or removal—means the removal of oil or hazardous substances from the water and shorelines or taking necessary actions to minimize or mitigate damage to the public health or welfare. Under this Plan, removal refers to Phase III and IV response operations.

(r) Size classes of discharges—The following classifications are provided as guidance for the OSC and serve as the criteria for the actions delineated in Section 1510.63. They are not meant to imply associated degrees of hazard to the public health or welfare, nor are they a measure of environmental damage. Any discharge that poses a substantial threat to the public health or welfare, or results in critical public concern shall be classed as major discharge regardless of the following quantitative measures.

(1) Minor discharge—means a discharge to the inland waters of less than 1000 gallons of oil; or a discharge to the coastal waters of less than 10,000 gallons of oil; or a discharge of a hazardous substance in a quantity less than that defined as reportable by regulation (40 CFR Part 117).

(2) Medium discharge—means a discharge of 1,000 to 10,000 gallons of oil to the inland waters; or a discharge of 10,000 gallons to 100,000 gallons of oil to the coastal waters; or a discharge of a hazardous substance equal to or greater than a reportable quantity as defined by regulations (40 CFR Part 117).

(3) Major discharge—means a discharge of more than 10,000 gallons of oil to the inland waters; or more than 100,000 gallons of oil to the coastal waters; or a discharge of a hazardous substance that poses a substantial threat to the public health or welfare, or results in critical public concern.

(s) United States—means the States, the District of Columbia, the Commonwealth of Puerto Rico, the Canal Zone, Guam, American Samoa, the Virgin Islands, and the Trust Territory of the Pacific Islands.

## Subpart B—Responsibility

**§ 1510.21 Federal responsibility.**

(a) This Plan seeks to insure a coordinated Federal response at the scene of a discharge, or a potential discharge of oil or hazardous substance that poses a threat to the public health or welfare. In the event of a discharge, the Federal OSC shall first promptly determine (under section 311(c)(1) of the Act) whether the person responsible for the discharge is taking proper action to remove the discharge or threat of discharge. If practicable, the OSC shall make the person responsible aware of his financial responsibility. If the OSC determines that the person responsible is taking proper action, the OSC shall monitor progress and provide advice. If the person responsible does not act promptly or fails to take proper removal actions, or if the person responsible is unknown, or if a potential discharge is considered to exist, further Federal response actions shall be undertaken promptly in accordance with this Plan.

(b) Removal actions taken under section 311(c)(1) of the Act are limited to the areas described in § 1510.3(a) (Scope of Plan). When a discharge or potential discharge that poses a threat to U.S. waters, occurs outside the Plan's jurisdiction, the procedures of this Plan and those of regional and local plans apply to the extent practicable; removal will take place under other legal authorities.

(c) In accordance with section 311(d) of the Act, whenever a marine disaster in or upon the navigable waters of the United States has created a substantial threat of a pollution hazard to the public health or welfare, because of a

discharge or an imminent discharge of large quantities of oil or a hazardous substance from a vessel, the United States may:

(1) Coordinate and direct all public and private efforts for the removal or elimination of the threat; and

(2) Summarily remove and, if necessary, destroy the vessel by whatever means are available without regard to any provisions of law governing the employment of personnel or the expenditure of appropriated funds. The authority for these actions has been delegated under Executive Order 11735 to the Administrator of EPA and the Secretary of the Department in which the Coast Guard is operating, respectively, for the waters for which each designates the OSC under this Plan.

(d) When the Administrator of EPA or the Secretary of the Department in which the Coast Guard is operating determines there is an imminent and substantial threat to the public health and welfare because of an actual or threatened discharge of oil or hazardous substance into or upon the waters of the United States from any onshore or offshore facility, he may require, through the Attorney General, that the U.S. Attorney of the district in which the threat occurs secure the relief necessary to abate the threat. The NRT may request EPA or the USCG to exercise this authority. The action described here is in addition to any other actions taken by a state or local government for the same purpose.

(e) Federal agencies with facilities or other resources which may be useful in a Federal response situation will make those facilities or resources available for use in accordance with this Plan and the regional and local plans. Federal resources shall be made available to the extent possible, consistent with agencies' operational requirements, within the limits of existing statutory authority, and within the spirit of the President's and the Congress intent to minimize discharges and their effects.

(f) Environmental pollution control techniques shall be employed in accordance with applicable regulations and guidelines, and regional and local contingency plans. In any circumstances not covered by regulations, the use of chemicals shall be in accordance with Annex X and must have the concurrence of the EPA representative or alternate representative on the RRT. In the absence of the EPA representative or alternate, the concurrence of the appropriate EPA regional administrator must be obtained.

(g) Response actions to remove discharges originating from Outer Continental Shelf Lands Act operations shall be in accordance with the August 1971 Memorandum of Understanding between DOI and DOT concerning respective responsibilities under this Plan.

(h) Discharges of radioactive materials shall be handled pursuant to the Interagency Radiological Assistance Plan which is administered by the Department of Energy.

**§ 1910.22 Duties of Federal agencies.**

(a) Each of the participating Federal agencies has duties established by statute, Executive Order, or Presidential directive which may be relevant to the Federal response to a pollution discharge. See Annex IV for a description of applicable legal authorities. Regional contingency plans shall call upon agencies to discharge these duties in a coordinated manner. They shall provide for:

(1) Identification of the statutory responsibilities of all agencies involved;

(2) Prompt notification of agency representatives in the event of a threatened or actual oil or hazardous substances spill;

(3) Designation of agency representatives to assist OSCs in developing local contingency plans; and

(4) Coordination of agency representatives with the OSC during a pollution incident (see § 1510.36(a)(3)).

(b) The following Federal agencies have specific duties and responsibilities which are relevant to a response to discharges of oil or hazardous substances:

(1) The Council on Environmental Quality is responsible for preparing, publishing, revising and amending the National Contingency Plan. The NRT will advise CEQ on necessary changes to the Plan and CEQ shall insure that any disagreements among participating agencies are expeditiously settled.

(2) The Department of Agriculture provides expertise in managing agricultural, forest, and wilderness areas and in selecting landfill disposal sites. The Soil Conservation Service can provide to the OSC predictions of the effects of pollutants on soil and their movements over and through soil.

(3) The Department of Commerce, through NOAA, shall provide scientific expertise on living marine resources for which it is responsible, including endangered species and marine mammals (see § 1510.36(a)(3)); coordinate scientific support, provide current and predicted meteorologic, hydrologic, ice and oceanographic conditions for the high seas, coastal, and inland waters; provide charts and maps, including tide and current information, for coastal and territorial waters and the Great Lakes; and assist EPA in damage assessment in coastal areas and on the high seas. When requested by NRT, DOC through MarAd will provide advice on the design, construction and operation of merchant ships.

(4) The Department of Defense, consistent with its operational requirements, may provide assistance in maintaining navigation channels, in the removal of navigation obstructions, and in salvage. Upon request of the OSC, NRT, or USCG, the services and special equipment of the Supervisor of Salvage, USN will be provided as available for the cleanup and control of oil spills. Upon request from the OSC, locally deployed Navy equipment may be provided.

(5) The Department of Energy administers, implements, and coordinates the Interagency Radiological Assistance Plan (IRAP). DOE will advise the NRT when assistance is required in identifying the source and extent of radioactive contamination, and in the removal and disposal of radioactive discharges.

(6) The Department of Health, Education, and Welfare is responsible for providing expert advice and assistance on discharges or potential discharges that pose a threat to public health and safety.

(7) Federal Emergency Management Agency participates in the development and evaluation of national, regional, and local oil and hazardous substance pollution contingency plans in accordance with Executive Order 12148, Section 2–1; monitors responses related to such plans in accordance with Executive Order 12148, Section 2–2; and evaluates State Governors' requests for Presidential declarations of major disasters or determinations of emergency under Pub. L. 93–288 (42 U.S.C. 4401, *et seq.*), the Disaster Relief Act of 1974.

(8) The Department of Interior, through the USGS, can provide expertise in the fields of oil drilling, producing, handling, and transportation by pipeline. The USGS supervises continuously manned facilities which can be used for command, control and surveillance of discharges occurring from operations conducted under the Outer Continental Shelf Lands Act. The Bureau of Mines may provide analytical facilities which in an emergency could be of aid in identifying inorganic hazardous substances. Through its pollution response coordinators, the Fish and Wildlife Service of DOI will provide technical expertise to the OSC and RRT on fish and wildlife and their habitats, including migratory birds, marine

mammals, and endangered and threatened plants and animals (See § 1510.36(a)(3)). DOI is responsible for implementing this plan in American Samoa and the Trust Territory of the Pacific Islands when required.

(9) The Department of Justice can provide expert advice on complicated legal questions arising from discharges and Federal agency responses.

(10) The Department of Labor, through the Occupational Safety and Health Administration, will provide the OSC with advice, guidance, and assistance regarding hazards to persons involved in removal or control of oil or chemical spills, and in the precautions necessary to prevent hazards to their health and safety.

(11) The Department of Transportation provides expertise on all modes of transporting oil and hazardous substances. Through the USCG, DOT offers expertise in the domestic/international fields of port safety and security, marine law enforcement, ship navigation and construction, and the manning, operation, and safety of vessels and marine facilities. The USCG also maintains continuously manned facilities which can be used for command, control, and surveillance of oil discharges occurring on the waters of the United States or the high seas. For those areas where it provides the OSC, the USCG chairs the RRT which develops, implements, and revises the regional and local contingency plans as necessary.

(12) The Department of State will lead in developing joint international contingency plans. It will also help to coordinate an international response when pollution discharge crosses international boundaries or involves foreign flag vessels. Additionally, this Department will coordinate requests for assistance from foreign governments and U.S. proposals for conducting research at incidents that occur in waters of other countries.

(13) The Environmental Protection Agency provides expertise on environmental effects of pollution discharges and environmental pollution control techniques. EPA will also advise the RRT and OSC on what degree of hazard a discharge poses to the public health and safety, and will coordinate scientific support, including assessment of damages, in the inland regions. For those areas where it provides the OSC, EPA chairs the RRT which develops, implements, and revises regional and local contingency plans as necessary. EPA will coordinate with USCG in the preparation of regional and local contingency plans for pollution control and protection of the environment.

(c) All Federal agencies are responsible for minimizing the possibility of discharges; for developing the capability to respond promptly to discharges from facilities they operate or supervise; and for making resources available for Federal pollution response operations.

(d) In addition to their general responsibilities under paragraph (c) of this section, participating agencies are responsible for:

(1) Leading all Federal agencies in programs to minimize environmental damage associated with discharges from facilities they operate or supervise;

(2) Providing representation as necessary to the NRT and RRTs, and giving assistance to the RRTs and OSCs in formulating regional and local contingency plans;

(3) Developing the operating capability in their particular areas of expertise for a rapid response to any pollution discharge in coordination with other Federal agencies;

(4) Making necessary information available to the NRT, RRT, or OSC; and

(5) Informing the NRT and RRTs (consistent with national security considerations) of changes in the availability of resources that would affect the operation of this Plan.

**§ 1510.23 Non-Federal participation.**

(a) Every State Governor is asked to assign an office or agency to represent the State on the RRT. The State's representative should participate fully in all facets of RRT activities and shall designate the element of the State government that will direct state supervised discharge removal operations. Participation of officials from municipalities with major ports and waterways is also invited in the RRT. (See § 1510.34(f).)

State and local government agencies are encouraged to include contingency planning for discharge removal in all emergency and disaster planning. Federal local contingency plans required by this Plan shall be coordinated with plans developed by state and local governments. This is especially important for traffic control, land access, and disposal of pollutants in removal operations.

(b) States, industry groups, academic organizations, and others are encouraged to commit resources for removal operations. Specific commitments shall be listed in Federal regional and local contingency plans. EPA and the USCG should explore the possibility of concluding memoranda delegating responsibility to concerned States for cleanup of certain spills. Details on reimbursement to states for removal actions taken under to this Plan are contained in § 1510.65 and 33 CFR Part 153.

(c) It is particularly important to coordinate the technical information generated by scientists from the Federal and State governments, from industry, universities, and elsewhere to assist the OSC in developing cleanup strategies in environmentally sensitive areas; to assist in the performance of post spill damage assessments; and to assure that pertinent research will be undertaken to meet national needs. The scientific support aspect of this Plan is described in § 1510.34.

(d) Federal local contingency plans should establish procedures to allow for well-organized and worthwhile employment of volunteers. Local plans should provide for the direction of volunteers by the OSC, or by other Federal, local or state officials knowledgeable in contingency operations and capable of providing leadership. Local plans should also identify specific areas in which volunteers can best be used such as: beach surveillance, logistical support, bird and wildlife treatment, and scientific investigations. Normally, volunteers should not be used for physical removal of pollutants. If the substance discharged is toxic to humans, or if in the judgment of the OSC other dangerous conditions exist, volunteers shall not be permitted at on-scene operations. Regional and local contingency plans should provide for routine education and training of volunteers so that training during an actual incident will not be necessary. Information on discharge and removal efforts should be provided to volunteers frequently during the course of planning to insure coordinated effort and meaningful participation.

## Subpart C—Organization

**§ 1510.31 Emergency response activities and coordination.**

(a) In a pollution emergency, the OSC is responsible for Federal on-scene coordination. The OSC provides reports to and receives advice from the RRT charged with regional coordination. The RRT is composed of representatives from the regional and district offices of the participating agencies, States, and local governments.

(b) National coordination is accomplished through the NRT which receives reports from and provides guidance and advice to the RRTs. Activities are coordinated through the facilities of the national and regional response centers.

(c) The organization of this Plan is shown in Figure 1.

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# National Contingency Plan Concepts

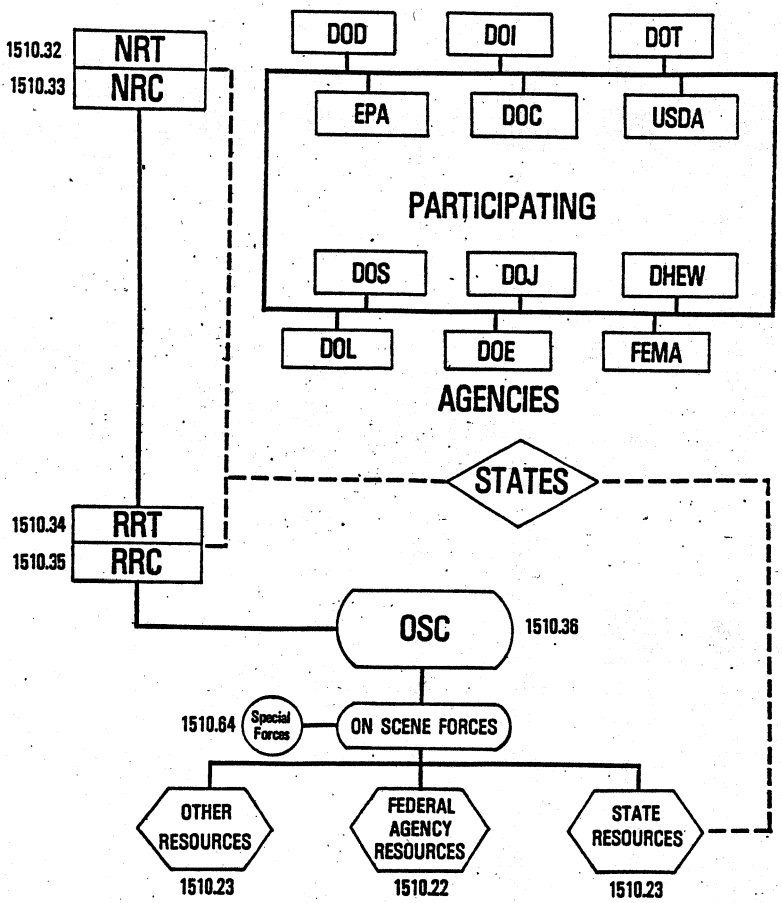


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Figure 1

**§ 1510.32 National Response Team.**

(a) The NRT consists of representatives from the participating agencies. It is the national body for planning and preparedness before a pollution discharge and for coordination and advice during a discharge. Each participating agency shall designate a member to the team and sufficient alternates to insure representation.

(b) Except for periods of activation because of a pollution incident, the representative of EPA shall be the chairman and the representative of DOT shall be vice-chairman of the NRT. The vice-chairman shall maintain records of NRT activities along with national, regional and local plans for pollution response. When the NRT is activated for a pollution incident, the chairman shall be the representative of EPA or DOT, depending upon the area in which the response is taking place.

(c) NRT meetings are open to the public. Upon invitation of the chairman and with the consent of members, non-government observers may participate without vote in any meeting of the NRT on matters of their direct concern. They shall be provided with reports issued by the NRT. Invitations to participate shall be given to a non-Government organization if:

(1) The organization can reasonably be expected to make a significant contribution to the work of the Team;

(2) The organization's work, past and present, has a direct relationship to the work of the Team; and

(3) The organization is not represented at the NRT through another organization.

(d) Normally, when the NRT is not activated for a pollution incident, it shall serve as a standing committee to evaluate the preparedness of the agencies and effectiveness of plans for responding to pollution discharges, to recommend needed policy changes in the response organization, and to recommend revisions to this Plan as needed.

(e) The NRT shall consider and make recommendations to appropriate agencies on the training and equipping of response teams; necessary research, development, demonstration, and evaluation to improve response capabilities; and equipment, material stockpiling, and other operational matters as the need arises. CEQ shall be advised of any agency's failure to respond adequately to these recommendations.

(f) The NRT shall recommend revisions of this Plan to CEQ for approval and publication.

(g) Scientific advisors shall be designated, from EPA, DOC-NOAA, and DOI-FWS, to advise the NRT on scientific matters related to pollution response, and to coordinate and oversee the regional scientific support mechanism (see § 1510.64). They shall also evaluate and advise the NRT on the desirability of carrying out research affecting waters and resources not under the jurisdiction of the United States.

(h) The NRT shall establish and maintain a Research and Development Committee to:

(1) Provide the latest information on Federal agencies' research, development, and demonstration activities for spill response and cleanup;

(2) Respond to NRT requests for scientific and technical information;

(3) Identify appropriate research and development initiatives;

(4) Provide for information exchange between agencies on response research, development, and demonstration projects. The committee shall report to the NRT at the June and December meetings and at other times upon request.

(i) Ad hoc committees may also be established from time to time. Representatives from the participating agencies with direct involvement in such committees' charters shall serve on these committees.

(j) Planning and preparedness responsibilities of the NRT are to:

(1) Make a continuing review of regional responses to pollution incidents, with an evaluation of equipment readiness and coordination among responsible public agencies and private organizations.

(2) Consider necessary changes in policy on the basis of the continuing review of regional responses to pollution incidents;

(3) Develop procedures to ensure the coordination of Federal, state, local government, and private responses to pollution incidents;

(4) Review regional plans and reports of activities from RRTs, and make sure that RRTs are functioning satisfactorily.

(5) Inform the Research and Development Committee on research requirements identified during discharges of unusual materials or under unique circumstances;

(6) Review continuously and act upon reports by the Research and Development Committee;

(7) Maintain readiness to respond to a nationally significant discharge of oil or hazardous substances;

(8) Monitor incoming reports from all RRTs and activate the NRT for a pollution incident when appropriate; and

(9) Meet monthly or more frequently to review pollution emergency response actions of the preceding period, receive reports from the R&D Committee and ad hoc committees. Information on the time and place of meetings may be obtained from the National Response Center (see § 1510.33).

(k) The NRT shall be activated as an emergency response team when requested by any team representative or when a discharge:

(1) Exceeds the response capability of the region in which it occurs;

(2) Transects regional boundaries; or

(3) Involves significant population hazards or national policy issues, substantial amounts of property, or substantial threats to natural resources.

When acting as an emergency response team, the NRT shall consist of representatives from the participating agencies. Each representative or an appropriate alternate shall be notified immediately by telephone of the emergency activation of the NRT.

(l) When activated for a pollution incident the NRT shall meet at the call of the chairman and shall:

(1) Monitor and evaluate reports from the OSC. The NRT may recommend to the OSC, through the RRT, actions to combat the discharge;

(2) Request other Federal, state, and local governments, or private agencies to consider providing resources under their existing authorities to combat a discharge of monitor response operations;

(3) Coordinate the supply of equipment, personnel, or technical advice to the affected region from other regions or districts; and

(4) Prepare public information releases and transfer information between the OSC and the Washington, D.C., headquarters of the agencies concerned. Public information is discussed in § 1510.37.

(m) The NRT shall consider any matter referred to it for settlement by an RRT or OSC when the matter cannot be resolved at regional level on an interagency basis. Unless circumstances dictate otherwise, further actions will not be taken on matters thus referred to NRT until the NRT position has been transmitted to the RRT and OSC. Any member of an RRT may petition the NRT for a review of matters considered by the RRT. Petitioning RRT members may appear before the NRT to present their arguments but shall not have the right to vote in NRT deliberations on the disputed matter. While the NRT desires to achieve a consensus on all matters brought before it, certain matters may prove unresolvable through normal debate or discussion. In such cases,

each cabinet department or independent agency serving as a participating agency on the NRT shall be accorded one vote in NRT proceedings.

**§ 1510.33 National Response Center.**

(a) The NRC is the national communications center for activities related to pollution incidents. It is located at the Washington, D.C., Headquarters of the USCG. Notice of discharges should be made through a toll free number, a special local number, or through telephone and teletype circuits. (Details appear below and in Annex V.) The NRC relays notices of discharge to the appropriate OSC. It disseminates OSC and RRT reports to the NRT when appropriate. It provides facilities for the NRT to use in coordinating a national pollution emergency response when required.

(b) The Commandant, U.S. Coast Guard, shall provide the necessary communications, plotting facilities, and equipment. These will include:

(1) A continuously manned communication center for receiving reports of discharges;

(2) Telephone branch lines;

(3) Teletypewriter circuits;

(4) The latest updated charts of the Departments of Commerce, Interior and Defense for the U.S. waters, the Continental Shelf and the ocean areas adjacent to the U.S. Territorial waters;

(5) Technical library on oil and hazardous substances pollution (described in Annex VII); and

(6) Plotting and display facilities to depict the geographic position, movement, and extent of the discharge.

(c) The USCG shall furnish technical manuals and materials, and necessary administrative support to operate the NRC effectively and efficiently.

(d) Participating agencies may use normal communication circuits to fulfill their responsibilities under the Plan. Telephone numbers for the primary notification offices of interested agencies will be maintained in NRC and in RRCs.

(e) First notice of a pollution discharge shall be made immediately (in accordance with 33 CFR 153.203) either to the NRC Duty Officer, HQ USCG, Washington, D.C., toll free telephone (800) 424–8802 (or 426–2675 in the Washington, D.C., local calling area), or to the predesignated OSC (see Annex III). All notices of discharges received at the NRC shall be relayed immediately by telephone to the OSC. The NRC shall evaluate incoming information and immediately advise FEMA of potential major disaster situations.

(f) Pollution Reports (POLREPS) shall be submitted by the RRT to the NRC as developments occur and not later than 1600 local time on each day of a pollution response operation. Pollution Reports shall be disseminated by the NRC to NRT members as requested by those members.

**§ 1510.34 Regional Response Team.**

(a) The RRT serves as the regional body for planning and preparedness actions before a pollution discharge and for coordination and advice during a pollution discharge. The RRT consists of regional representatives of the participating agencies, state, and local government representatives as appropriate. The full participation of high level representation from States and local governments with major ports and waterways is desired. (See §§ 1510.23(a) and 1510.34(f).)

(b) Except when the RRT is activated for a pollution incident, the representatives of EPA and DOT shall act as co-chairmen. When the RRT is activated for a pollution incident, the chairman shall be the representative of EPA or DOT, depending upon the area of the spill and the response.

(c) Each participating agency shall designate one member and at least one alternate member to the RRT. Participating States and local governments should also designate one member and at least one alternate member to the Team. Agencies may also provide additional representatives as observers to meetings of the RRT. Persons representing Federal and State agencies shall be specified in each regional contingency plan.

(d) RRT members shall designate representatives from their agencies to work with OSCs in developing local contingency plans, providing for the use of agency resources, and in responding to pollution incidents.

(e) The chairman of RRT shall ensure that the regional and local contingency plans adequately provide the OSC with assistance from the Federal agencies commensurate with agencies' resources, capabilities and responsibilities within the region. During a pollution emergency, the members of the RRT shall insure that the resources of their agencies are made available to the OSC as specified in the regional and local contingency plans.

(f) Affected states are encouraged to participate actively in all RRT activities (see § 1510.23(a)), to designate representatives to work with the RRT and OSC's in developing regional and local plans, plan for and make available State resources, and serve as the contact point for coordination with local government agencies in responding to pollution incidents. When the RRT is activated for a pollution emergency, affected States are invited to participate in all RRT deliberations. Any State or local government representative who participates in the RRT has the same status as any Federal member of the RRT.

(g) When not activated for a pollution incident, the RRT serves as a standing committee to recommend needed policy changes in the regional response organization, to revise the regional plan as needed, and to evaluate the preparedness of the agencies and the effectiveness of local plans for the Federal response to pollution incidents. The RRT shall:

(1) Make a continuing review of regional and local responses to pollution incidents, considering equipment readiness and coordination among responsible public agencies and private organizations;

(2) Recommend revisions to this National Contingency Plan to the NRT, on the basis of observations of response operations;

(3) Consider and recommend necessary changes in policy on the basis of the continuing review of regional responses to pollution incidents;

(4) Develop procedures to insure the coordination of Federal, State, local government, and private responses to pollution incidents;

(5) Review the functioning of OSCs to insure that local contingency plans are developed satisfactorily;

(6) Be prepared to respond to a major discharge of oil or hazardous substances outside its region;

(7) Monitor incoming reports from all OSCs and activate the RRT when appropriate; and

(8) Meet quarterly to review response actions carried out during the preceding period, and consider changes in both regional and local contingency plans. In those regions having both coastal and inland RRTs, RRT meetings held in alternating quarters (inland in March, coastal in June, etc.) would meet this requirement.

(9) RRTs shall provide letter reports on their activities to the NRT twice a year, no later than 31 January and 31 July. The reports will help to identify techniques and procedures that have worked well and subjects requiring improvement and should be circulated to other RRTs. At a minimum, reports will contain paragraphs covering:

(i) *Summary of Activities*, containing highlights of routine meetings and activations during the reporting period;

(ii) *Organizational Matters*, Outlining improvements made since the last report. Organizational matters requiring NRT action should be included. RRTs

are encouraged to add detailed accounts of successful procedures;

(iii) *Operations*, including recommendations, comments or observations on response methods, equipment, training or other operational matters which have not been addressed in the review of OSC reports.

(h) Each coastal RRT is required to conduct an annual training exercise in which response equipment is actually deployed. These exercises should use all existing capabilities in the local port area. Any funding required to support the exercise should be requested through the normal agency budget process. The RRT shall cooperate to the fullest extent possible in field exercises of member agencies.

(i) RRTs for inland regions are strongly encouraged to conduct an annual training exercise in which response equipment is actually deployed. RRTs for inland regions shall cooperate to the fullest extent possible in field exercises of member agencies.

(j) The RRT shall be activated as an emergency response team when a discharge:

(1) Exceeds the response capability available to the OSC in the place where it occurs;

(2) Transects regional boundaries; or

(3) Poses a substantial threat to the public health and welfare or to regionally significant amounts of property. Regional contingency plans shall specify detailed criteria for activation of RRTs.

(k) The RRT shall be activated automatically in the event of a major or potential major discharge. The RRT may be activated during any other pollution emergency by an oral request from any RRT representative to the chairman of the Team. Requests for Team activation shall later be confirmed in writing. Each representative, or an appropriate alternate, shall be notified immediately by telephone when the RRT is activated. POLREPS to the NRC from RRTs shall include the time of Team activation, method of activation (e.g., telephone) and place of assembly (if appropriate).

(l) When activated for a pollution incident, agency representatives shall meet at the call of the chairman and shall:

(1) Monitor and evalute reports from the OSC. The RRT shall advise the OSC on the duration and extent of Federal response and may recommend to the OSC specific actions to combat the discharge;

(2) Request other Federal, state or local government, or private agencies to consider providing resources under their existing authorities to combat a discharge or monitor response operations;

(3) Help the OSC prepare information releases to the public and for communication with the NRT. Public information is discussed in § 1510.37;

(4) Advise the regional head of the agency providing the OSC if the circumstances or progress of a pollution discharge indicate that a different OSC should be designated; and

(5) Submit Pollution Reports (POLREPS) to the NRC as developments occur and not later than 1600 local time of each day of the operation.

(m) Whenever insufficient national policy guidance exists on a matter before the RRT, or there is a question concerning the interpretation of national guidance, the matter shall be referred to the NRT for resolution. Time permitting, further actions will not be taken on such issues until the NRT has transmitted a position to the OSC and RRT. Should the matter directly affect a State or local government, the RRT representatives of the affected governments may express their position to the NRT.

(n) If any member of the RRT dissents from a decision of the RRT on a discretionary action pursuant to the Plan, or an interpretation of the plan, that member may appeal the decision to the NRT in accordance with § 1510.32(m). The dissenting member shall notify the chair of the NRT of its appeal. During a major pollution discharge, a member who has pursued an appeal to the NRT may request further review by CEQ.

(o) Any State or local government representative who participates in the RRT has the same status as any Federal member of the RRT. Although it is preferable that RRT's reach consensus views, there may be occasions when a vote is necessary. On those occasions, each Federal cabinet level or independent agency, the directly affected State, and the directly affected local government shall be accorded one vote only.

(p) The RRT shall be deactivated by agreement between the EPA and USCG team members. The time of deactivation shall be included in POLREPS.

(q) Boundaries for regional contingency plans shall follow those of the Standard Regions for Federal Administration as shown in Annex III. Boundaries for local contingency plans shall coincide with those agreed upon between EPA and the USCG to determine OSC areas of responsibility and shall be clearly indicated in the regional contingency plan.

**§ 1510.35 Regional Response Center.**

The RRC is the regional center for pollution response activities. Each regional plan shall specify quarters for the RRC. The RRC provides facilities and personnel for communications, information storage, and other requirements for coordinating the response to pollution incidents.

**§ 1510.36 On-Scene Coordinator.**

(a) The OSC shall direct Federal pollution control efforts and coordinate all other Federal efforts at the scene of a discharge or potential discharge. The OSC shall be predesignated, as part of the planning and preparation for response to pollution incidents, by the regional or district head of the agency responsible for providing the OSC.

(1) The first official from an agency with responsibility under this plan to arrive at the site of a discharge shall coordinate activities under the Plan until the OSC arrives.

(2) The OSC shall collect pertinent facts about discharge, such as potential impacts on human health and welfare; the nature, amount, and location of discharged materials; the probable direction and time of travel of discharged materials, the natural resources, including fish and wildlife and their habitat, and property which may be affected and the priorities for protecting them.

(3) The OSC shall direct Phase II, Phase III and Phase IV operations; that is, Evaluation and Initiation of Action, Containment and Countermeasures; and Removal, Mitigation and Disposal (see Subpart E, §§ 1510.51–55 for descriptive details). Advice provided by the EPA on the use of chemicals in Phase III and Phase IV operations shall be binding on the OSC, except as provided in Annex X of this Plan. Advice provided by the Fish and Wildlife Service (DOI) or by the National Oceanic and Atmospheric Administration (DOC) on cleanup actions that may affect endangered and threatened species or their habitats shall be considered at all times and shall be binding on the OSC unless in his judgment actions contrary to this advice must be taken to protect human life.

(4) The OSC shall provide necessary support and documentation for Phase V activities (Documentation and Cost Recovery).

(5) The OSC will consult regularly with the RRT in carrying out this Plan and will keep the RRT fully informed of all activities under the Plan.

(b) EPA and the USCG shall designate OSCs for all areas in each region. The EPA shall furnish or provide OSCs for inland waters. The USCG shall furnish or provide OSCs for the coastal waters.

and for Great Lakes waters, ports and harbors.

(c) All Federal agencies are required by Executive Order to develop emergency plans and procedures for dealing with oil and hazardous substances spills caused by facilities or vessels under their jurisdiction. All Federal agencies, therefore, are responsible for designating the offices that will coordinate response actions for spills caused by facilities or vessels under their jurisdiction and for providing means to remove or mitigate such spills in accordance with this Plan and applicable Federal regulations and guidelines. If the responsible Federal agency does not act promptly or take appropriate action, to respond to a spill caused by a facility or vessels under its jurisdiction, the EPA or USCG (depending on the area where the discharge occurs) shall assume the OSC functions.

(d) The OSC is responsible for developing and maintaining a local contingency plan (Federal local plan) for the Federal response in the area of the OSC's responsibility. Designated Federal, State, and local representatives to the RRT shall assist in these efforts. (See § 1510.42.)

**§ 1510.37 Public information network.**

(a)(1) When a major pollution incident occurs, it is imperative to give the public prompt, accurate information on the nature of the discharge and actions underway to mitigate the damage. Those immediately capable, especially local fire, police and governmental officials, will be contacted first so they may use all available resources to notify the public of a potential threat. Prompt disclosure of the facts helps to encourage cooperation by interested parties and to check the spread of misinformation. National administration policy and the Freedom of Information Act both call for maximum disclosure of information.

(2) If a participating agency believes public interest warrants the issuance of statements or releases and the on-scene or national news offices have not been activated, the affected agency should recommend activation. In the interim, all news releases or statements issued by participating agencies concerning the incidents will be cleared through the OSC.

(b) When the NRT is activated, the Team chairman will contact the most appropriate agency and ask it to detail a professional information officer to establish and direct a national news office. Whenever possible, the director of the national news office shall be provided by the same agency providing the OSC. Requests by the director of the national news office for an appropriate number of professional and clerical assistants will be met by one or more of the participating agencies.

(1) The director of the national news office will be responsible for overall supervision of public information activities of the NRT. The closest possible coordination will be maintained between the national news office in Washington and the on-scene news office.

(2) Promptly after his designation, the director of the national news office will contact the White House Press Office and the Office of Governmental and Public Affairs to arrange whatever information assistance may be required by these offices.

(3) All national news office news releases will be cleared by the chairman of the NRT, or in his absence, the vice-chairman.

(4) The Director of the national news office will have free access to meetings of the NRT and will be consulted on the possible public reaction to the courses of action under consideration by the NRT.

(5) At appropriate intervals, the director of the national news office may arrange news conferences at which the NRT will respond to questions from the media representatives.

(6) The director of the national news office will keep appropriate nationally-based press offices posted on developments. These include the press offices of the secretaries or directors of the participating agencies; Senators and Representatives whose States or districts are affected by the incident.

(7) The national news office will be provided with adequate space, telephones, typewriters, communications equipment and other supplies by the U.S. Coast Guard at U.S. Coast Guard Headquarters, Washington, D.C. The director of the national news office will determine what equipment and supplies are needed to insure an orderly flow of information and to accommodate visiting members of the news media.

(c) An on-scene news office will be established upon the request of any agency participating on the RRT or the OSC to coordinate media relations and issue official Federal information on a pollution incident. The office will be staffed according to regional plans and applicable agency directives. Whenever possible, the on-scene news office will be headed by a representative of the agency providing the OSC. Any participating agency may, by request to the RRT, place a representative on the staff of the news office. The OSC shall determine location of the on-scene news office but every effort should be made to locate it near the scene of the pollution incident.

(1) The director of the on-scene news office shall coordinate all public information activities for the OSC. The director's functions include:

(i) Arranging news conferences for the OSC and other officials to make progress reports and respond to questions;

(ii) Keeping local and regional government officials informed of the pollution situation through contacts with their press offices or other representatives;

(iii) Keeping news media informed about the response effort and giving them as much cooperation as possible, for example, by arranging transportation to the scene of a pollution incident when possible;

(iv) Issuing and distributing daily news releases so long as public interest warrants;

(v) Giving citizens who make inquiries up-to-date information from the latest press release;

(vi) Observing public reaction to the pollution incident and advising the OSC of any actions that might better serve public information interests;

(vii) Handling queries from public and commercial interests properly and promptly;

(viii) Referring salesmen to technical personnel assigned to evaluate their wares;

(ix) Upon request, offering special public information services for official visitors, including notifying the news media of the time, place and purpose of official visits; making press conference arrangements; and arranging for interviews;

(x) Informing the public on the proper way to deal with individual problems and damages from the pollution incident; and

(xi) If necessary, drafting a model letter for participating agencies to use in answering mail inquiries, after the crisis has subsided. The model letter must be approved by the Chairman of the NRT.

(2) It is important for the on-scene news office to describe accurately in news releases each agency's contribution to the response effort, and to make sure that the various agencies assisting the OSC are represented at press conferences.

(3) Each OSC and supporting district or regional office must establish contacts and a working relationship with the regional news media as part of preparation and planning before a pollution incident occurs.

(d)(1) A Public Information Assistance Team (PIAT) shall be available to help OSCs and agenies' regional offices meet the demands for public information during a major pollution incident or threatened incident. Team members will be trained in journalism, public relations, and photography, and will have a knowledge of pollution response techniques, equipment, and the laws and regulations relating to pollution incidents. PIAT will be based at U.S. Coast Guard Headquarters and can be requested through the NRC any time.

(2) If the NRT has not been activated, the PIAT can serve as a center for answering inquiries in Washington, D.C., upon request of the parent agency of the OSC.

## Subpart D—Plans

### § 1510.41 Regional contingency plans.

(a) The RRTs shall develop regional contingency plans for each standard Federal region. The purpose of these plans is coordination of a timely, effective response to pollution incidents by various Federal agencies and other organizations. Regional contingency plans must have a broad scope. They must include information on all useful facilities and resources in the region, from government, commercial, academic and other sources. To the greatest extent possible, regional plans will follow the format of the National plan. An example of the desired format is in Annex II.

(b) Each region includes many scientists who can make significant contributions to the response activities of the OSC and RRT. Regional Scientific Support Coordinators (SSCs) shall organize and coordinate these scientists and their contributions to the greatest extent possible. SSCs with advice from RRT members, shall also develop the parts of the regional plan that relate to scientific support.

### § 1510.42 Local contingency plans.

(a) Each OSC if responsible for developing a local contingency plan for the Federal response in his area of responsibility (Federal local plans). The plan should provide for a well-coordinated response that allows integration of or compatibility with pollution response plans of local, State and non-Federal entities. The plan shall identify environmentally sensitive areas, the probable locations for pollution incidents, the kinds of resources required to respond to pollution incidents, where such resources can be obtained, plans of action for protecting vulnerable resources, methods and sites for disposal of recovered oil and hazardous pollutants consistent with local and state plans developed under the Resource Conservation and Recovery Act (42 U.S.C. 6901, *et seq.*), and a local structure for responding to pollution incidents. The Federal local plan shall be developed in concert with and shall be consistent with fire emergency and disaster plans prepared by State and local agencies. To the greatest extent possible, Federal local plans will follow the sample format in Annex II.

(b) While the OSC is responsible for developing Federal local plans, a successful planning effort depends upon the full cooperation of all agency representatives, and includes the development of local capabilities to respond to pollution incidents. Particular attention must be given, during the planning process, to developing a multiagency local response team for coordinating on-scene efforts. The RRT must ensure proper liaison between the OSC and local representatives of RRT members.

A National inventory of pollution response and support equipment (SKIM) has been developed to help OSCs and RRTs gain rapid access to resources during emergencies. This inventory is accessible through the NRC, remote data terminals at Coast Guard Districts and Marine Safety Offices, and Captain of the Port Offices. The inventory shall include privately or commercially owned equipment as well as government resources. Regional and local planners shall ensure that data in the system are current and accuate, so that OSCs can make full use of it during emergencies, with minimal delays in obtaining needed resources. The Coast Guard is responsible for keeping the national inventory up to date with information from the regional offices of Federal agencies.

## Subpart E—Operational-Response Phases

### § 1510.51 Phase I—Discovery and notification.

(a) A discharge or potential discharge may be discovered through: (1) A report submitted by a discharger in accordance with statutory requirements; (2) deliberate search by vessel patrols and aircraft; and (3) random or incidental observation by Government agencies or the public.

(b) A discharge or potential discharge discovered through deliberate search should be reported directly to the NRC. Reports of random discovery may be provided by fishing or pleasure boats, fire and police departments, telephone operators, port authorities, news media, or others. Such reports should be made to the NRC or the nearest USCG or EPA office. (See § 1510.33(e) and Annex III).

Regional and local plans shall provide for all reports to be channeled to the NRC, RRC, and appropriate State agency (as agreed upon with each State) as promptly as possible. Reports of major and medium discharges received by either EPA or USCG shall be expeditiously relayed by telephone to appropriate members of the RRT as specified by the regional contingency plan. Reports of minor discharges shall be exchanged between EPA and USCG as agreed to by the two agencies.

(c) The agency furnishing the OSC for a particular area is responsible for implementing Phase I activities in that area.

### § 1510.52 Phase II—Evaluation and initiation of action.

(a) The OSC shall ensure that a report of a discharge or potential discharge is immediately investigated. On the basis of all available information, the OSC shall: (1) Evaluate the magnitude and severity of the discharge or threat; (2) determine the feasibility of removal; and (3) assess the effectiveness of removal actions.

(b) When appropriate and as soon as possible after receipt of a report, the OSC shall advise the RRC of the need to initiate further Federal response actions. The actions may be no more than activation of the RRT, or a request for additional resources for further surveillance, or they may extend to Phase III or Phase IV containment or removal operations.

(c) The OSC shall ensure adequate surveillance over whatever actions are initiated. If effective actions are not being taken to eliminate the threat, or if removal is not being properly done, advise the responsible party. If the responsible party does not then take proper actions, or if the discharger is unknown or is otherwise unavailable, the OSC shall, pursuant to § 311(c)(1) of the Act, take whatever actions are necessary to eliminate the threat or remove the pollutant.

### § 1510.53 Phase III—Containment and countermeasures.

Defensive actions should begin as soon as possible after a discharge or potential discharge is discovered. This phase may include actions to protect the public health and welfare such as: analyzing water samples to determine the source and spread of the pollutants; procedures to control the source of discharge; measures to keep waterfowl and other wildlife away from the polluted area; damage control or salvage operations; placement of physical

barriers to deter the spread of a pollutant; use of booms or barriers to protect specific installations or areas; control of the water discharged from upstream impoundments; and the use of chemicals and other materials, in accordance with Annex X, to restrain the spread of the pollutant and mitigate its effects.

**§ 1510.54 Phase IV—Cleanup, mitigation and disposal.**

(a) Actions should be taken to recover the pollutant from the water and affected shorelines. These actions include: the use of sorbents, skimmers and other collection devices for floating pollutants; the use of vacuum dredges or other devices for sunken pollutants; the use of reaeration or other methods to mitigate damage from dissolved, suspended, or emulsified pollutants; and special treatment techniques to protect public water supplies or fish and wildlife resources from continuing damage.

(b) Pollutants and contaminated materials recovered in cleanup operations shall be disposed of in accordance with regional and local contingency plans (see § 1510.42(a)).

**§ 1510.55 Phase V—Documentation and cost recovery.**

(a) Documentation and cost recovery may involve a variety of actions, depending on the discharge. Recovery of Federal removal costs and recovery for damage done to Federal, State, or local government property is included. Damages to private citizens (including loss of earnings) are not addressed by this Plan. OSCs shall furnish documentation required by the revolving fund administrator to support Federal efforts to recover costs from responsible parties. Procedures to be followed to fulfill documentation requirements are specified in the Coast Guard directives in the 16450.1 series.

(b) Information and samples needed for legal and scientific purposes shall be collected during this phase. Information and samples are necessary for later identification of financially responsible parties, for scientific understanding of the environment, and for research and development. The samples and information must be gathered at the proper time during the removal operations, because otherwise wind and current may disperse the evidence.

(1) All agencies shall follow uniform procedures, described in Annex VI, for collection of samples and information.

(2) The OSC shall take necessary actions during response phases to ensure necessary collection and safeguarding of information, samples, and reports.

(c) The information and reports obtained by the OSC shall be transmitted to the RRC. Copies will then be forewarded to the NRC, members of the RRT, and others as appropriate.

**§ 1510.56 Pollution reports.**

(a) Within 60 days after the conclusion of a major pollution discharge and when requested by the RRT, the OSC shall submit to the RRT a complete report on the response operation and the actions taken. The OSC shall at the same time send a copy of the report to the NRT. The RRT shall review the OSCs report and submit the report and an endorsement to the NRT for review. This shall be accomplished within 30 days after the report has been received.

(b) The OSC's report shall accurately record the situation as it developed, the actions taken, the resources committed and the problems encountered. The OSC's recommendations, based on these experiences, are a source for new procedures and policy.

(c) The format for OSC's reports will be as follows:

(1) *Summary of Events.*—This part is a chronological narrative of all events, including:

(i) The cause of the incident;

(ii) The initial situation;

(iii) The organization of the response; and

(iv) The resources committed.

These sections may be presented separately or included in the narrative. If applicable, the following information will also be included:

(v) The location (water body, State, city, latitude and longitude) of the spill; whether the discharge was in connection with activities regulated under the OCSLA or Deepwater Port Act; or whether it might have or actually did affect natural resources under the exclusive management authority of the United States;

(vi) Details of Federal or State efforts to replace or restore damaged natural resources; and

(vii) Details of any threat abatement actions taken under sections 311(c) or (d) of the Act.

(2) *Effectiveness of Response and Removal Actions.*—This part should candidly and thoroughly analyze the effectiveness of the response and removal actions taken by:

(i) The discharger;

(ii) State and local forces;

(iii) Federal agencies and special forces; and

(iv) (If applicable) contractors, private groups and volunteers.

(3) *Problems Encountered.*—This part should list any problems encountered and describe how they affected the response. Particular attention should be given to any problems of intergovernmental coordination that may have occurred.

(4) *Recommendations.*—This section should include all recommendations of the OSC. An endorsement from the RRT shall be included. At a minimum the following areas should be covered:

(i) Means to prevent a recurrence of the incident;

(ii) Improvement of response actions.

Any recommended changes in the regional or National contingency plans should also be included.

**§ 1510.57 Special considerations.**

(a) *Safety of personnel.*—Actual or potential polluting discharges threatening damage to air and water can also threaten human health and safety. The OSC should be aware of the hazards, should exercise great caution in allowing civilian or government personnel into the affected area until the nature of the substance discharged is known, and due caution should be exercised thereafter. Local contingency plans shall identify sources of information on anticipated hazards, precautions, and requirements to protect personnel during response operations. Names and phone numbers of people with relevant information shall be included.

(b) *Waterfowl conservation.*—Oil discharges, particularly in estuarine and near shore areas, often cause severe stress to resident and migratory bird species. The DOI representative and the state liaison to the RRT shall arrange for and coordinate actions of professional and volunteer groups wishing to participate in waterfowl dispersal, collection, cleaning, rehabilitation, and recovery activities. Regional and local contingency plans shall, to the extent practicable, identify organizations or institutions that are willing to participate in such activities and operate such facilities. Waterfowl conservation activities will normally be included in Phase III and Phase IV response actions (§§ 1510.53 and 1510.54 of this subpart).

**Subpart F—Coordinating Instructions**

**§ 1510.60 Delegation of authority.**

As provided by Annex X of this Plan, EPA delegation of authority or concurrence in the use of chemical pollution control activities initially may be oral; however, written confirmation by the EPA representative on the RRT

should be completed as soon as possible.

**§ 1510.62 Multi-regional actions.**

(a) If a discharge or a potential discharge moves from the area covered by one Federal local or regional contingency plan into another area, the authority for pollution control actions shall likewise shift. If a polluting discharge or potential discharge affects areas covered by two or more regional plans, the response mechanism of both plans shall be activated. In this case, pollution control actions of all regions concerned shall be fully coordinated as detailed in the regional plans.

(b) There shall be only one OSC at any time during the course of a response operation. Should a discharge affect two or more areas, the EPA and USCG will designate the OSC, giving prime consideration to the area vulnerable to the greatest damage. The RRT shall designate the OSC if EPA and USCG members are unable to agree on designation. The NRT shall designate the OSC if members of one RRT or of two adjacent RRTs are unable to agree on the designation.

**§ 1510.63 General pattern of response actions.**

(a) When the OSC receives a report of a discharge or potential discharge, he should normally take action in the following sequence:

(1) Investigate the report to determine pertinent information such as the threat posed to public health or welfare, the type and quantity of material discharged, and the source of the discharge.

(2) Notify RRT members and the Scientific Support Coordinator, in accordance with the applicable regional plan.

(3) Determine, in accordance with section 311(c)(1) of the Act, whether the discharger (that is, the owner or operator of the vessel, onshore facility, or offshore facility from which the discharge occurs) is properly carrying out removal actions. Removal is being done properly when:

(i) The discharger's cleanup is fully sufficient to minimize or mitigate damage to the public welfare. The discharger's removal efforts are "improper" to the extent that Federal efforts are necessary to prevent further damage; and

(ii) The discharger's removal efforts are in accordance with applicable regulations and guidelines, including this Plan, especially Annex X.

(4) Officially classify the severity of the discharge and determine the course of action to be followed.

(5) Determine whether state action to effect removal is necessary within the meaning of section 311(c)(2)(H) of the Act (See § 1510.65(h)).

(b) The preliminary inquiry will probably show that the situation falls into one of five classes. These classes and the appropriate response to each are outlined below:

(1) If the investigation shows that the initial information overstated the magnitude or danger of the discharge and no environmental pollution or potential pollution is involved, the case shall be considered a false alarm and should be closed.

(2) If the investigation shows a minor discharge with the discharger taking appropriate removal action, contact should be established with the discharger. The removal action should be monitored to insure continued proper action by the discharger.

(3) If the investigation shows a minor discharge with improper removal action being taken, the following measures shall be taken:

(i) An immediate effort should be made to prevent further discharges from the source.

(ii) The discharger shall be advised of the proper action to be taken.

(iii) If the discharger does not follow this advice, warning of the discharger's liability for the cost of removal, pursuant to § 311(f) of the Act, shall be given.

(iv) The OSC shall notify appropriate state and local officials. He shall keep the RRC advised and initiate Phase III and IV operations as conditions warrant.

(v) Information shall be collected for possible recovery of removal costs when removal is effected in accordance with § 1510.55.

(4) When a report of investigation indicates that a medium discharge has occurred, or the potential for a medium discharge exists, the OSC shall follow the same general procedures as for a minor discharge. Additionally, the OSC shall make a recommendation concerning team activation to the chairman of the RRT.

(5) When a report indicates that a major discharge has occurred, a potential major pollution emergency exists, or that a discharge or potential discharge which could arouse wide public concern has occurred, the OSC shall follow the same procedures as for minor and medium discharges. The RRC and NRC shall, however, be notified immediately of the situation even if the initial report has not been confirmed.

**§ 1510.64 Special forces available to the OSC.**

(a) The National Strike Force consists of the Strike Teams established by USCG on the East, West and Gulf Coasts and includes the emergency task forces to provide assistance to the OSC during Phase II, IV, and V operations as the circumstances of the situation dictate. When possible, the Strike Teams will provide training to the emergency task forces and participate with the RRT in regional and local contingency plan development.

(1) The Strike Teams can provide communications support, advice, and assistance for oil and hazardous substances removal. These teams also have knowledge of ship salvage, damage control, diving and removal techniques. Additionally, they are equipped with specialized containment and removal equipment, and have rapid transportation available.

(2) Emergency task forces, established by the USCG at major ports pursuant to section 311(c)(2)(C) of the Act, consist of trained personnel with supplies of oil and hazardous substances pollution control equipment and materials, and detailed discharge removal plans for their areas of responsibility.

(3) The Strike Teams will respond to requests for assistance from the OSC. Requests for a team may be made directly to the Commanding Officer of the appropriate team, the Coast Guard member of the RRT, the appropriate area commander, USCG, or to the Commandant, USCG through the NRC. Emergency task forces work directly for the OSC and are accessible through those offices.

(b)(1) The Environmental Response Team (ERT) is established by EPA in accordance with its disaster and emergency responsibilities. The ERT includes expertise in biology, chemistry and engineering. It can provide access to special decontamination equipment for chemical spills and advice to the OSC on:

(i) Cleanup techniques and priorities;

(ii) Water supply contamination and protection;

(iii) Application of dispersants;

(iv) Habitat restoration; and

(v) Disposal of contaminated material.

The ERT will be especially useful to the OSC in hazardous substances spill response and in damage assessment for all spills.

(2) The OSC or RRT requests for ERT support should be made to the EPA representative on the RRT, the EPA Headquarters emergency coordinator or the appropriate EPA regional emergency coordinator.

(c)(1) Scientific support is organized by EPA and NOAA, with assistance from DOI, to support the OSC by providing scientific assistance including: oceanography, chemistry, location of environmentally sensitive areas, assessment of environmental damage and coordination of on-scene scientific activity. Generally, the Scientific Support Coordinator (SSC) for coastal oil spills will be provided by NOAA and those for inland spills will be provided by EPA. This delineation of responsibility may be modified within a region by agreement between DOC, DOI and EPA representatives to the RRT.

(2) Scientific support coordinators serve as advisors to the RRT and OSC in planning and on the OSC staff during major spill response operations.

(i) In planning, the SSC works with the RRT to identify vulnerable resources within the region and to establish and maintain a scientific support structure within the region. The structure should be adequate to provide the OSC with well qualified scientific assistance. Specific responsibilities of the SSC in planning are:

(aa) Establish contact with the scientific community within the region, including State, local, university, industry and others, to determine the existing capability to perform damage assessment that may be necessary in support of the OSC. In those regions whose states have well developed scientific organizations, they should be employed to support the OSC.

(bb) Organize the development of those portions of regional and local contingency plans that deal with scientific support to the OSC and the responsibilities of agencies that must perform damage assessment of pollution incidents. The SSC shall advise each OSC of scientists who can provide scientific advice in assessing effects of spills in localized areas.

(cc) Identify, in cooperation with the region's scientific community, research (basic or applied, data gathering, processing, etc.) required to support the OSC in mitigating the effects of spills and improve the existing capability to support damage assessment.

(ii) When requested by the OSC, the SSC will function as a member of the OSC's staff. In that capacity, the SSC functions as the liaison between the scientific community and the OSC. The extent and nature of SSC involvement in the operational mode shall be determined by the OSC. In order to provide an orderly and intelligible flow of information to the OSC, act as a mediator among differing scientific opinions, and advise the OSC on use by scientific personnel of limited common resources such as aircraft and vessels, the SSC shall:

(aa) Coordinate response from scientific to OSC requests for assistance and to requests from RRT agencies for performance of damage assessment investigations; coordinate responses and requests from scientists interested in performing research on spills.

(bb) Serve as the principal liaison for scientific advice from the scientific community to the OSC. The SSC shall ensure that differing scientific views within the scientific community are communicated to the OSC in timely manner.

(3) The SSC will respond to requests for assistance from the OSC or from the chairman of the appropriate RRT. Details on provision of the access to scientific support shall be included in regional contingency plans.

(d) The activation or involvement of any special forces shall not relieve the OSC of any responsibilities for notification and activation of any member agency of the RRT concerning a pollution incident. The activation and involvement of any special forces will not replace or impede the response actions of any RRT agencies in carrying out responsibilities outlined in § 1510.22, or in providing advice or assistance to the OSC or RRT relative to a pollution incident.

**§ 1510.65 Funding.**

(a) If the person responsible for the discharge or threat of discharge does not act promptly, or take proper removal actions, or if the person responsible for the discharge is unknown, Federal discharge removal actions may begin under section 311(c)(1) of the Act. The discharger, if known, is liable for the costs of Federal removal in accordance with section 311(f) of the Act.

(b) Actions undertaken by the participating agencies in response to pollution shall be carried out under existing programs and authorities insofar as practicable. This Plan intends that Federal agencies will make resources available, expend funds, or participate in response to pollution incidents under their existing authority. Authority to expend resources will be in accordance with agencies' basic statutes and, if required, through cross-servicing agreements. Specific interagency reimbursement agreements may be signed when necessary to ensure that the Federal resources will be available for a timely response to a pollution incident. The ultimate decision as to the appropriateness of expending funds rests with the agency that is held accountable for such expenditures.

(c) A pollution revolving fund, administered by the Commandant, USCG, has been established pursuant to section 311(k) of the Act. Regulations governing the administration and use of the fund are contained in 33 CFR Part 153. The OSC shall exercise sufficient control over removal operations to be able to certify that reimbursement from the fund is appropriate.

(d) Funding of response actions other than removal, such as scientific investigations not in support of removal actions or law enforcement, shall be provided by the agency with legal responsibility for those specific actions.

(e) The funding of removal actions necessitated by a discharge from a Federally operated or supervised facility or vessel is the responsibility of the operating or supervising agency.

(f) The following agencies have funds available for certain discharge removal actions:

(1) The EPA can provide funds to begin timely discharge removal actions when the OSC is an EPA representative. Because EPA does not have funds authorized for this purpose, operating program funds may be used to initiate Phase III and IV activities; funding of continuing Phase III and IV actions, however, shall be determined on a case-by-case basis by the Oil and Special Materials Control Division at EPA.

(2) The USCG pollution control efforts are funded under "operating expenses." These funds are used in accordance with agency directives and applicable regional plans.

(3) The Department of Defense has two specific sources of funds which may be applicable to a pollution incident under appropriate circumstances. (This does not consider military resources which might be made available under specific conditions.)

(i) Funds required for removal of a sunken vessel or similar obstruction of navigation are available to the Corps of Engineers through Civil Functions Appropriations, Operations and Maintenance, General.

(ii) The U.S. Navy has funds available on a reimbursable basis to conduct salvage operations.

(g) Certain emergency response activities under this plan may qualify for reimbursement as disaster relief functions. In making a declaration of a "major disaster" or a determination that an "emergency" exists, the President may allocate funds from his Disaster Relief Fund, managed by the Director, Federal Emergency Management Agency. The Director may then authorize certain reimbursements to Federal agencies for assistance provided under direction of his office. (See Title

24, CFR Chapter XIII, Part 2201, "Reimbursement of Other Federal Agencies under Pub. L. 91-606 (For use under Pub. L. 93-288 until revised).) The Director, FEMA, may also make financial assistance available to state governments and, through the states, to local governments (See Title 24, CFR Chapter XIII, Part 2205, "Federal Disaster Assistance").

(h) Pursuant to section 311(c)(2)(H) of the Act, the State or States affected by a discharge of oil or hazardous substances may act where necessary to remove such discharge and may, pursuant to 33 CFR Part 153, be reimbursed from the pollution revolving fund for the reasonable costs incurred in such removal.

(1) Removal by a state is necessary within the meaning of section 311(c)(2)(H) of the Act when the OSC determines that the owner or operator of the vessel, onshore facility, or offshore facility from which the discharge occurs cannot effect removal properly and that:

(i) State action is required to minimize or mitigate significant damage to the public health or welfare which Federal action cannot minimize or mitigate, or

(ii) Remove or partial removal can be done by the State at a cost which is less than or not significantly greater than the cost which would be incurred by the Federal departments or agencies.

(2) State removal actions must be in compliance with Annex X of this Plan in order to qualify for reimbursement.

(3) State removal actions are considered to be Phase III or Phase IV actions, under the same definitions applicable to Federal agencies.

(4) Actions taken by local government in support of Federal discharge removal operations are considered to be actions of the State for purpose of this section.

(i) Regional and local contingency plans shall show what funds and resources are available from participating agencies under various conditions and cost arrangements. Interagency agreements may be necessary to specify when reimbursement is required.

**Annex I—1100 Distribution**

*1101 Plan Distribution*

1101.1 This Plan will be distributed to designated offices of participating Agencies, state and interstate water pollution control agencies and such other Federal, state, local and private agencies and organizations which are cooperating with and participating in activities in support of the Plan.

1101.2 Included in this formal distribution are the following:

Department of Agriculture
Department of Commerce
Department of Defense
Department of Energy
Department of Health, Education and Welfare
Department of the Interior
Department of Justice
Department of Labor
Department of State
Department of Transportation
Environmental Protection Agency
Federal Emergency Management Agency
All state representatives to regional response teams
All state water pollution control agencies
All interstate water pollution control agencies
Other Federal, state, local and private agencies and organizations, as appropriate

1101.3 Formal distribution of the Plan and amendments will be made by the Environmental Protection Agency.

*1102 Amendment, Distribution and Format*

1102.1 Amendments to the Plan and annexes will be made by sequentially numbered changes. Numbered changes will be effected by means of a transmittal sheet which identifies the Plan, the change number and date, the page numbers affected by the change and any other instructions deemed necessary for purpose of clarity or to make special emphasis or explanation of the change. There will be attached to the transmittal sheet the revised or added pages with the change number and current date on each page at the upper right hand corner.

1102.2 Where a change can be effected merely by pen and ink, the transmittal sheet may be used to accomplish the change without submission of revised pages. The use of pen and ink changes is limited to those cases where existing matter is being deleted or is of minor extent.

1102.3 Asterisks will be used to indicate changes. For line changes, an asterisk will be placed before and after each sentence change in the left and right page margins. For paragraph changes, an asterisk will be placed before and after each paragraph changed and if continued on the next page, an asterisk will be placed at the top of the page and the end of the paragraph. For a paragraph deletion, an asterisk will be placed in the left margin and the paragraph number or letter will be retained in the original sequence followed by the word "Rescinded" in parentheses.

1102.4 If the Plan is completely rewritten, asterisks will not be used supersession will be indicated at the bottom of the first page.

**Annex II—Formats for Regional and Local Contingency Plans**

*Regional Contingency Plan*

Letter of Promulgation.
Record of Amendments.
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103 Scope.
104 Abbreviations.
105 Definitions.

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201 Federal Policy.
202 Multi-National Policy.
203 Federal Responsibility.
204 Non-Federal Responsibility.

300 Planning and Response Organization
301 Spill Response Activity and Coordination—General.
302 Regional Response Team.
303 Regional Response Center.
304 On-Scene Coordination.
305 Special Forces.

400 Coordinating Instructions
401 Delegation of Authority.
402 Notification.
403 Multi-regional Responses.
404 Multi-national Responses.
405 Coordination with Special Forces.
406 Termination of Response Activities.
407 Resolution of Disputes.

500 Procedures for Reviewing and Updating the Regional and Local Contingency Plans
501 Responsibility.
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Annex II—1200 Regional Response Team.
Annex III—1300 Regional Response Center.
Annex IV—1400 Geographical Boundaries.
Annex V—1500 Notifications, Communications and Reports.
Annex VI—1600 Public Information.
Annex VII—1700 Legal Authorities.
Annex VIII—1800 Documentation for Enforcement and Cost Recovery.
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Annex X—2000 Cleanup Techniques and Policies.
Annex XI—2100 Arrangements for Participation of Non-Federal Groups.
Annex XII—2200 Interagency Support Agreements/Arrangements.
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Annex XV—2500 Regional Data Base.
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*Local Contingency Plans*

Letter of Promulgation.
Record of Amendments.
Table of Contents.
List of Effect Pages.

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105 Definitions.

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202 Related State Policy.
203 Multi-national Policy.
204 OSC Responsibility.
205 Non-Federal Responsibility.

300 Planning and Response Considerations
301 Oil and Hazardous Substances Transportation Pattern.
302 Transfer Storage and Processing Facilities.
303 Historical Spill Considerations.
304 Hydrological and Climatological Considerations.
305 Local Geography.
306 Highly Vulnerable Areas.
307 Local Response Resources.

308 Waterfowl Conservation.
309 Endangered Species.

400 Response Organization

500 Operational Response Actions

600 Coordination Instructions

601 Delegation of Authority.
602 Notification.
603 Coordination with Special Forces.
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605 Resolution of Disputes.

700 Procedures for Reviewing and Updating the Local Contingency Plan

Annex I—1100 Distribution.
Annex II—1200 Pollution Response Personnel Assignments.
Annex III—1300 Geographical Boundaries.
Annex IV—1400 Notifications, Communications and Reports.
Annex V—1500 Public Information.
Annex VI—1600 Documentation for Enforcement and Cost Recovery.
Annex VII—1700 Funding.
Annex VIII—1800 Clean up Techniques and Policies.
Annex IX—1900 Arrangements for Non-Federal Groups.
Annex X—2000 Interagency Support.
Annex XI—2500 Geographical/Action Directory.
Annex XVI—2600 Response/Assistance Directory.

**Annex III—Regions and Office Locations of EPA and the Coast Guard**

1300 Geographical Boundaries

Regional contingency plans shall be based upon the Standard Federal Regions. Local plans shall be based upon the subregional area, for which each OSC is responsible for responding to pollution incidents. These plans are available for inspection at EPA regional offices or USCG district offices as shown in 1301 and 1302. Other agencies' addresses and telephone numbers may be found in the United States Government Manual (issued annually) or in the local telephone directories.

1301 Environmental Protection Agency—Office addresses, telephone numbers, and map.

1302 Department of Transportation—United States Coast Guard district offices addresses, telephone numbers, and map.

Environmental Protection Agency, Region I Room 2303, John F. Kennedy Federal Bldg., Boston, MA 02203, Tel: (617) 223-7265.
Environmental Protection Agency, Region II, Room 908, 26 Federal Plaza, New York, NY 10007, Tel: (201) 548-8730.
Environmental Protection Agency, Region III, Curtis Building, 6th & Walnut Streets, Philadelphia, PA 19106, Tel: (215) 597-9898.
Environmental Protection Agency, Region IV, 345 Courtland Street, NE, Atlanta, GA 30308, Tel: (404) 881-4062.
Environmental Protection Agency, Region V, 336 South Clark Street, Chicago, IL 60605, Tel: (312) 353-2318.
Environmental Protection Agency, Region VI, 1201 Elm Street, First International Bldg., Dallas, TX 75270, Tel: (214) 749-3840.
Environmental Protection Agency, Region VII, 1735 Baltimore Street, Kansas City, MO 64108, Tel: (816) 374-3778.
Environmental Protection Agency, Region VIII, Suite 900, 1860 Lincoln Street, Denver, CO 80295, Tel: (303) 837-3880.
Environmental Protection Agency, Region IX, 215 Freemont Street, San Francisco, CA 80295, Tel: (303) 837-3880.
Environmental Protection Agency, Region X, 1200 Sixth Avenue, Seattle, WA 98101, Tel: (206) 442-1200.

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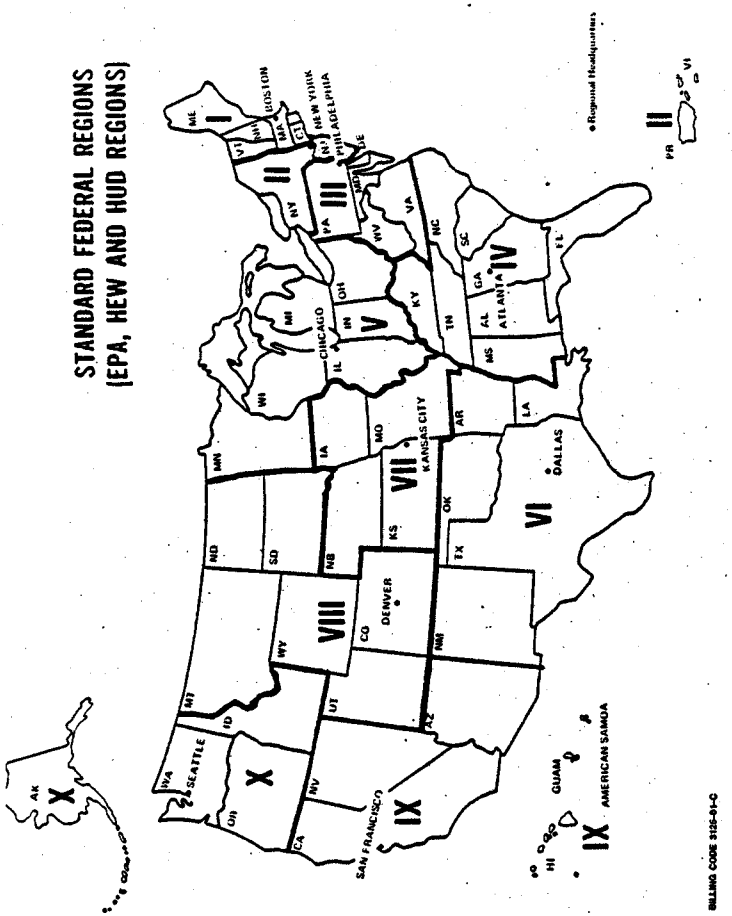
## STANDARD FEDERAL REGIONS
## (EPA, HEW AND HUD REGIONS)



**1302 Department of Transportation, U.S. Coast Guard Districts**

1st Coast Guard District, 150 Causeway Street, Boston, MA 02114, Duty Officer: (617) 223–3645.
2nd Coast Guard District, 1430 Olive Street, St. Louis, MO 63101, Duty Officer: (314) 425–4614.
3rd Coast Guard District, Governors Island, New York, NY 10004, Duty Officer: (212) 668–7055.
5th Coast Guard District, Federal Building, 431 Crawford Street, Portsmouth, VA 23705, Duty Officer: (804) 398–6231.
7th Coast Guard District, Room 1018, Federal Building, 51 SW 1st Avenue, Miami, FL 33130, Duty Officer: (305) 350–5611.
8th Coast Guard District, Hale Boggs Federal Building, 500 Camp Street, New Orleans, LA 70130, Duty Officer: (504) 589–6225.
9th Coast Guard District, 1240 East 9th Street, Cleveland, OH 44199, Duty Officer: (216) 293–3984.
11th Coast Guard District, Union Bank Building, 400 Oceangate Boulevard, Long Beach, CA 90822, Duty Officer: (213) 590–2225.
12th Coast Guard District, 630 Sansome Street, San Francisco, CA 94126, Duty Officer: (415) 556–5500.
13th Coast Guard District, 915 2nd Avenue, Seattle, WA 98174, Duty Officer: (206) 442–5866.
14th Coast Guard District, Prince Kalanianaole Fed. Bldg., 300 Ala Moana, Honolulu, HI 96850, Duty Officer: (808) 546–7109 (commercial only), AUTOVON—(315) 430–0111.
17th Coast Guard District, P.O. Box 3–5000, Juneau, AK 99802, Duty Officer: (907) 586–7340 (commercial only), AUTOVON—(317) 386–7340.

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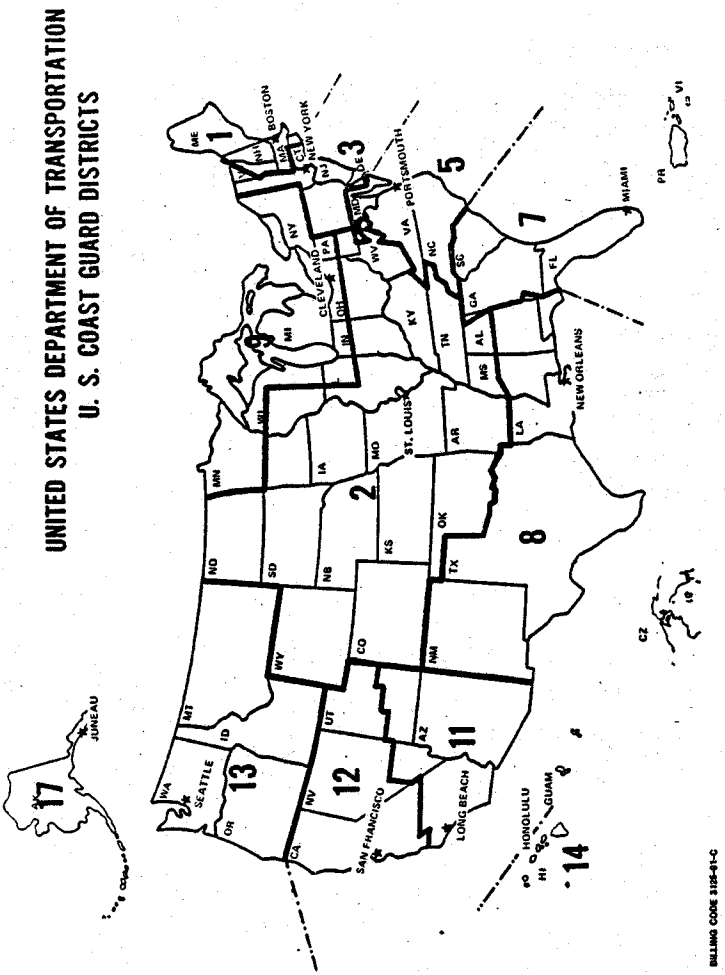
UNITED STATES DEPARTMENT OF TRANSPORTATION
U. S. COAST GUARD DISTRICTS
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NEW YORK
PORTSMOUTH
CLEVELAND
ST. LOUIS
MIAMI
NEW ORLEANS
JUNEAU
SEATTLE
SAN FRANCISCO
LONG BEACH
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**Annex IV**

1400 Legal Authorities.

1400.1 Federal statutes relative to control of pollution by oil and hazardous substances are administered by several departments and agencies. The following is a tabular summary of the most important of these authorities:

*Statute and Agency(ies)*

1411 Federal Water Pollution Control Act, as amended (33 USC 1251, et. seq.), EPA, USCG, CORPS, Justice

1412 Safe Drinking Water Act amendment to the Public Health Service Act (42 USC 201); EPA

1413 Refuse Act of 1899 (33 USC 407; 411); CORPS, USCG, Customs, Justice

1414 Toxic Substances Control Act, 1976 (42 USC 2601); EPA

1415 Resources Conservation and Recovery Act of 1976 (42 USC 6901); EPA

1416 Marine Protection, Research and Sanctuaries Act of 1976 (33 USC 1401 et. seq.); EPA, USCG, NOAA, CORPS

1417 Hazardous Materials Transportation Act of 1974 (49 USC 1801 et. seq.); DOT

1418 Ports and Waterways Safety Act as amended (33 USC 1221, et. seq.); USCG

1419 Federal Insecticide, Fungicide and Rodenticide Act of 1972 (7 USC 121 et. seq.); EPA

1420 Deepwater Port Act of 1974 (33 USC 1501 et. seq.); DOT, DOI

1421 Outer Continental Shelf Lands Act, as amended (43 USC 1331); DOI, DOT

1422 Oil Pollution Act of 1961, as amended (33 USC 1001–1001.5); USCG, Customs, CORPS, State

1423 Endangered Species Act of 1973, as amended (16 USC 1531); FWS, NOAA

1424 Intervention on the High Seas Act (33 USC 1471–1487); USCG

1430 Related Federal statues, not specific to oil and hazardous substances pollution control, but, nonetheless, applicable to discharge prevention and cleanup in certain cases are:

1431 Disaster Relief Act of 1974; FEMA. All Federal agencies

1432 U.S. Navy Ship Salvage Authority; U.S. Navy

1433 The Migratory Bird Treaty Act (16 USC 701–718); FWS

1440 Important International Conventions and Agreements relative to oil and hazardous substances pollution control and liability are:

1441 International Convention for the Prevention of Pollution of the Sea by Oil, 1954, and amendments

1442 Convention on the Territorial Sea and the Contiguous Zone

1443 Convention between the Government of the United States and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction, and Their Environment

1444 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter

**Annex V.—Communication Services Available in National Response Center**

*1501 Telephone (voice) services available include:*

1501.1 Commercial telephone available 24 hours per day, free (800) 424–8802 (or 426–2675 in the Washington, D.C. local calling area);

1501.2 AUTOVON (Automated Voice Network)—General purpose switched voice network of Defense Communications Systems, which serves Continental U.S., Alaska, Europe, Pacific, and Panama;

1501.3 Washington Tactical Switchboard—Pentagon terminal of the tactical telephone system, operated by USAF;

1501.4. FTS—GSA operated government administrative telephone system; and

1501.5 SARTEL—Search and Rescue Command Coordination telephone network including leased Hotline telephone net extending from Halifax to New Orleans.

1502 *Teletypewriter services available include:*

1502.1 AUTODIN—A worldwide high speed user data communications system operated for and managed by the DCA to provide both direct user-to-user and store and forward message switching service for DOD and other government agencies;

1502.2 SARLANT—Coast Guard-leased teletypewriter system extending from Massachusetts to Texas (used to control and coordinate search and rescue incidents and to handle other operational traffic and priority administrative communications);

1502.3 SARPAC—Same as 2.2 for the West Coast U.S.; and

1502.4 TELEX—Teletypewriter exchange service provided by Western Union that serves Continental U.S., industry and government offices. TELEX also permits direct connections.

**Annex VI.—Sample Collection Procedures**

*1601 Sample collection procedures to be followed by OSC:*

1601.1 Several precautions must be observed when taking and handling liquid samples for analyses as the character of the sample may be affected by a number of common conditions. These precautions concern the following: (a) The composition of the container; (b) cleanliness of the container; and, (c) manner in which the sample is taken.

1601.2 In taking such samples, the following procedures are to be followed in all cases:

1601.2–1 Glass or other appropriate containers of suitable size shall be used. The portion of the closure (sealing gasket or cap liner) which may come into contact with the sample in the container is of considerable importance. When oil or petroleum hydrocarbons are to be sampled, the closure should be made of glass, aluminum foil, or teflon. Pollutants other than oil may require special precautions such as jacketing of glass containers or different closure material. The analysis laboratory should be consulted whenever a question arises to the appropriateness of any packaging material.

1601.2–2 Previously unused containers are preferred. Containers that have been cleaned with a strong detergent, thoroughly rinsed, and dried may be used.

1601.2–3 Some explanatory notes governing the above procedures are as follows: (a) Glass or other appropriate containers always must be used because plastic containers, with the exception of teflon, have been found in some cases to absorb organic materials from water and, in other cases, compounds have been dissolved from plastic containers; (b) as it is desirable to take a large sample of the pollutant, proper skimming techniques should be used to obtain a sufficient amount of oil for analysis; and (c) because pollution conditions change rapidly, samples should be taken promptly, and the time sequences and locations noted.

1601.2–4 Consult with the analysis laboratory personnel relative to special samples and unusual problems.

1601.2–5 Samples collected are to be transmitted for analysis, using special courier or registered mail (return receipt requested). Appropriate analytical laboratories are designated in the regional plan. Reports of laboratory analysis will be forwarded to the appropriate RRT for transmittal to counsel.

**Annex VII.—1700 Technical Information**

*1701 Technical Library*

1701.1 A technical library of pertinent pollution control documents will be maintained in the NRC and in each RRC. Such information should be useful as reference information to the experienced OSC and instructional to less experienced personnel.

*1702 Specific References*

1702.1 As a minimum, the following reference documents will be maintained in the NRC and in each RRC technical library.

1702.1–1 Current National Oil and Hazardous Substances Pollution Contingency Plan.

1702.1–2 Current Regional and State Oil and Hazardous Substances Pollution Contingency Plan.

1702.1–3 Current Directory of the American Council of Independent Laboratories.

1702.1–4 Encyclopedia of Chemical Technology, 22 Vol., Kirkothmer, 2nd edition c1963–1971, John Wiley & Sons, New York, New York.

1702.1–5 Chemical Data Guide for Bulk Shipment by Water (U.S. Coast Guard CG–388)

1702.1–6 U.S. Army Corps of Engineers' Regulations ER 500–1–1 and ER 500–1–8 Emergency Employment of Army Resources (Natural Disaster Activities).

1702.1–7 Federal Disaster Assistance Program-Handbook for Applicants FDAA 3300.1, July 1973.

1702.1–8 Federal Disaster Assistance Program-Eligibility Handbook 3300.2, July 1973.

1702.1–9 Federal Disaster Assistance Program-Handbook for State and Federal Officials 3000.4, December 1973.

1702.1–10 Handbook of Toxicology (National Academy of Sciences/National Resource Council).

1702.1–11 46 CFR–146. Transportation or Storage of Explosives or Other Dangerous Articles or Substances, and Combustible Liquids on Board Vessels.

1702.1–12 33 CFR, 3, 5, 121, 122, 124–6. Security of Vessels and Waterfront Facilities (USCG CG 239).

1702.1–13 33 and 40 CFR parts implementing section 311 of the Federal Water Pollution Control Act, as amended.

1702.2 In addition to the library specified above, the RRC should have provision, either in publications or by computer terminal, for access to the EPA Technical Assistance Data System, (TADS) and the USCG Chemical Hazard Response Information System (CHRIS).

**Annex VIII Definitions of Terms**

1801 API gravity. An empirical scale for measuring the density of liquid petroleum products, the unit being called the "degree API".

1802 Ash. Inorganic residue remaining after ignition of combustible substances determined by definite prescribed methods.

1803 Asphalts. Black, solid or semi-solid, bitumens which occur in nature or are produced as residues during petroleum refining.

1804 Bilge oil. Waste oil which accumulates, usually in small quantities, in the lower spaces in a ship, just inside the hull plating. Usually mixed with larger quantities of water.

1805 Blowout. A sudden, violent escape of gas and oil from an oil well when high pressure gas is encountered and preventive measures have failed.

1806 Boiling point. The temperature at which the vapor pressure of a liquid is equal to atmospheric pressure.

1807 Bunker "C" oil. General term used to indicate a heavy viscous fuel oil.

1808 Bunker fuel. General term for heavy oils used as fuel on ships and in industry. It often refers to No. 5 and 6 fuel oils.

1809 Bunkering. The process of loading fuel aboard ship.

1810 Conversion tables. (Approximate Conversions).

| Materials: | *Barrel per ton (long)* |
|---|---|
| Crude oils | 6.7–8.1 |
| Aviation gasolines | 8.3–9.2 |
| Motor gasolines | 8.2–8.1 |
| Kerosenes | 7.7–8.3 |
| Gas oils | 7.2–7.9 |
| Diesel oils | 7.0–7.9 |
| Lubricating oils | 6.8–7.6 |
| Fuel oils | 6.6–7.0 |
| Asphalt bitumens | 5.9–6.5 |

(As a general rule-of-thumb, use 6.5 barrels or 250 gallons per ton of oil.)

1811 Crude oil. Petroleum as it comes from the earth. There may be several thousands of different substances in crude oil, some of which evaporate quickly while others persist indefinitely. The physical characteristics of crude oils may vary widely. Crude oils are often identified in trade jargon by their regions of origin. This identification may not relate to the apparent physical characteristics of the oil. Commercial gasoline, kerosene, heating oils, diesel oils, lubricating oils, waxes, and asphalts are all obtained by refining crude oil.

1812 Demulsibility. The resistance of an oil to emulsification, or the ability of an oil to separate from any water with which it is mixed. The better the demulsibility rating, the more quickly the oil separates from water.

1813 Density. Density is the term meaning the mass of a unit volume. Its numerical expression varies with the units selected.

1814 Emulsion. A mechanical mixture of liquids which do not naturally mix as oil and water. Water-in-oil emulsions have the water as the internal phase and oil as the external phase. Oil in water emulsions have oil as the internal phase.

1815 Fire point. The lowest temperature at which an oil vaporizes rapidly enough to burn for at least *5 seconds* after ignition, under standard conditions.

1816 Flash point. The lowest temperature at which an oil gives off sufficient vapor to form a mixture which will ignite, under standard conditions.

1817 Fraction. Refinery term for a product of fractional distillation having a restricted boiling range.

1818 Fuel oil grade. Numerical ratings ranging from 1 to 6. The lower the grade number, the thinner the oil is and the more easily it evaporates. A high number indicates a relatively thick, heavy oil. Number 1 and Number 2 fuel oils are usually used in domestic heaters, and the others are used by industry and ships. Number 5 and Number 6 oils are semi-solids that must be liquified by heating. Kerosene, coal oil, and range oil are all Number 1 oil. Number 3 is no longer used as a standard term for fuel oil.

1819 Innage. Space occupied in a product container.

1820 In personem. An action in personem is instituted against an individual, usually through the personal service of process, and may result in the imposition of liability directly upon the person of a defendant.

1821 In rem. An action in which the vessel or thing itself is treated as the offender and made defendant without any proceeding against the owners or even mentioning their names. The decree in an action in rem is enforced directly against the condemnation and sale thereof.

1822 Load On Top (LOT). A procedure for ballasting and cleaning unloaded tankers without discharging oil. Half of the tanks are first filled with seawater while the others are cleaned by hosing. Then oil from the cleaned tanks, along with oil which has separated out in the full tanks, is pumped into a single slop tank. The clean water in the full tanks is then discharged while the freshly-cleaned tanks are filled with seawater. Ballast is thus constantly maintained.

1823 Oil films. A slick thinner than .0001 inch and may be classified as follows:

| Standard term | Gallons of oil per square mile | Appearance |
|---|---|---|
| "Barely visible" | 25 | Barely visible under most favorable light conditions. |
| "Silvery" | 50 | Visible as a silvery sheen on surface water. |
| "Slightly colored" | 100 | First trace of color may be observed. |
| "Brightly colored" | 200 | Bright bands of color are visible. |

1833 Tonnage. There are various tonnages applied to merchant ships. The one commonly implied is gross tonnage although in these days tankers and other bulk-carriers are often referred to in terms of deadweight.

1833.1 Gross tonnage. 100 cubic feet of permanently enclosed space is equal to one gross ton—nothing whatever to do with weight. This is usually the registered tonnage although it may vary somewhat according to the classifying authority or nationality.

1833.2 Net tonnage. The earning capacity of a ship. The gross tonnage after deduction of certain spaces, such as engine and boiler rooms, crew accommodations, stores, equipment, etc. Port and harbor dues are based on this tonnage.

1833.3 Displacement tonnage. The actual weight in tons, varying according to whether a vessel is in light or loaded condition. Warships are always spoken of by this form of measurement.

1833.4 Deadweight tonnage. The actual weight in tons of cargo, stores, etc., required to bring a vessel down to her load line, from the light condition. Cargo deadweight is, as its name implies, the actual weight in tons of the cargo when loaded, as distinct from stores, ballast, etc.

1834 Ullage. The amount by which a tank or vessel lacks being filled. (See also Outage).

1835 Viscosity. The property of liquids which causes them to resist instantaneous change of shape, or instantaneous rearrangement of their parts, due to internal friction. The resistance which the particles of a liquid offer to a force tending to move them in relation to each other. Viscosity of oils is usually expressed as the number of seconds at a definite temperature required for a standard quantity of oil to flow through a standard apparatus.

1836 Viscous. Thick, resistance to flow, having a high viscosity.

1837 Volatile. Evaporates easily.

**Annex X—Schedule of Chemical and Other Additives to Remove Oil and Hazardous Substances Discharges**

*2001 General*

2001.1 This Schedule has been prepared by the U.S. Environmental Protection Agency pursuant to section 1(2) of Executive Order 11735. This Schedule applies to the waters of the United States and adjoining shorelines, the waters of the Contiguous Zone, and the high seas beyond the Contiguous Zone in connection with activities under the Outer Continental Shelf Lands Act or the Deep Water Port Act of 1974, or which may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States (including resources under the Fishery Conservation and Management Act of 1976).

2001.2 This Schedule applies to the use of any chemicals or other additives as hereinafter defined that may be used to remove oil and remove or neutralize hazardous substances discharges. Any chemical agent or other substance not specifically defined in this schedule will be considered by EPA on a case-by-case basis for use in the removal of oil and hazardous substances discharges.

2001.3 This Schedule favors development and utilization of sorbents, skimmers, booms and other mechanical control methods to remove or mitigate oil and remove, mitigate, or neutralize hazardous substances discharges from the environment with subsequent proper disposal.

2001.4 It is the intent of this Schedule that the use of chemicals and additives to remove or mitigate the effects of oil or hazardous substances discharges shall cause the least overall environmental impact.

2001.5 In implementing this Schedule and in maintaining its relationship with other Federal and State agencies, EPA shall recognize that some States may have more stringent laws, regulations or written policies regulating the use of chemicals in the removal of oil and hazardous substance discharges, in which case such laws, regulations or policies shall govern.

2001.6 It has been determined that because of the overriding need for prompt initiation of discharge removal actions no formal permit, as provided for by Sec. 402 of the Act, shall be required before application of chemicals to mitigate the effects of a discharge. The provisions of Sec. 1510.21(f) and 1510.36(a)(3) of this Plan shall apply.

*2002 Definitions*

Materials applied to oil or floating hazardous substances discharges are defined as follows:

2002.1 Chemical agents are those elements, compounds, or mixtures that disperse, dissolve, emulsify, neutralize, precipitate, reduce, solubilize, oxidize, concentrate, congeal, entrap, fix, gell, make the pollutant mass more rigid or viscous, or otherwise facilitate the mitigation of deleterious effects or removal of the pollutant from the water.

2002.2 Dispersing Agents are those chemical agents which emulsify, disperse, or solubilize oil into the water column or act to further the surface spreading of oil slicks in order to facilitate dispersal of the oil into the water column.

2002.3 Surface Collecting Agents are those chemical agents which are a surface film forming chemical for controlling oil layer thickness.

2002.4 Biological Additives are microbiological cultures, enzymes, or nutrient additives that are deliberately introduced into an oil or hazardous substance spill for the specific purpose of encouraging biodegradation to mitigate the effects of a spill.

2002.5 Burning Agents are those materials which, through physical or chemical means, improve the combustibility of the materials to which they are applied.

2002.6 Sinking Agents are those materials which are applied to oil and hazardous substance spills to sink floating pollutants below the water surface.

2002.7 Mechanical removal methods include the use of pumps, skimmers, booms, earthmoving equipment, and other mechanical devices.

2002.8 Sorbents are essentially inert and insoluble materials which are used to remove oil and hazardous substances from water through a variety of sorption mechanisms. Examples include: straw, expanded perlite, polyurethane foams, reclaimed paper fibers, peat moss.

*2003 Dispersing Agent Program for Spills of Oil and Applicable Hazardous Substances*

2003.1 Authorization for Use of Dispersing Agents

2003.1-1 Major and medium discharges. Dispersing agents may be used in any place, at any time, and in quantities designated by the OSC when their use will:

2003.1-1.1 In the judgment of the OSC, prevent or substantially reduce hazard to human life.

2003.1-1.2 In the judgment of the EPA RRT member on a case-by-case basis, in consultation with appropriate State or Federal agencies, prevent or reduce substantial hazard to a major segment of the population(s) of vulnerable species of waterfowl; or,

2003.1-1.3 In the judgment of the EPA RRT member on a case-by-case basis, in consultation with appropriate State and Federal agencies, result in the least overall environmental damage, or interference with designated water uses.

2003.1-2 Minor discharge. The provisions of section 2003.1-1 shall apply.

2003.2 Special Restrictions on Dispersing Agent Use:

2003.2-1 Chemical agents shall not be considered for use as dispersing agents unless technical product data have been provided and accepted in accordance with 2003.3 except when the judgment of the OSC the hazards discussed in 2003.1-1.1 are so imminent that the time delay for obtaining a dispersant agent that is in compliance with 2003.3 would be excessive.

2003.2-2 Federal officials responsible for oil and hazardous substance spill response activities at all levels shall develop effective programs to insure that dispersants that are available for use in appropriate spill response actions are dispersants with adequate technical data on file with EPA. This effort will help preclude the avoidance of the EPA technical data program by manufacturers or suppliers who might wish to take advantage of the emergency conditions provision of 2003.2-1.

2003.2-3 For all situations where dispersants are used, accurate records shall be kept on dispersant types, brands, application rates and methods, effectiveness, environmental impacts, plus any other pertinent observations.

2003.3 Technical Product Data For Dispersing Agents

2003.3-1 Technical product data as outlined in 2003.3-4 on the physical, chemical and toxicity characteristics of a dispersing agent shall be submitted to the Oil and Special Materials Control Division (WH-548), Environmental Protection Agency, Washington, D.C. 20460, at least 60 days prior to the use of the agent. Within 60 days of receipt of the data, EPA will inform, in writing, the submitter on the adequacy of the data provided. If additional information is requested or EPA desires to perform tests, the dispersing agent may not be considered for use until the additional needs have been satisfied and the submitter so notified.

2003.3-2 Information furnished in accordance with 2003.3-4 shall be maintained on file by the Environmental Protection Agency, Oil and Special Materials Control Division, (WH-548) Washington, D.C. 20460, to provide technical guidance to OSCs on the acceptable circumstances of use and dosage rates for dispersing agents. Any changes in the composition or formulation of the dispersing agent that will affect any of the data being requested in 2003.3-4 shall be immediately brought to the attention of EPA and testing of the agent will be repeated prior to the use of the revised dispersing agent.

2003.3-3 The acceptance and maintenance of product data by EPA does not constitute approval of the dispersing agent nor does it imply compliance with any EPA criterial or minimum standards for such agents. The OSC will determine which dispersing agent may be used for a spill event on a case-by-case basis using all available information in making such a decision. To avoid possible misinterpretation and misrepresentation of the EPA's role in this technical product data program, the manufacturer's representatives may use only the EPA letter advising compliance with 2003.3-4 in any advertisements or technical literature on the dispersing agent. The EPA letter must be used in its entirety. Failure to comply with these restrictions or any other improper reference to EPA in attempting to demonstrate EPA approval of the dispersing agent for use on spills of oil or hazardous substances shall constitute grounds for removing the technical product data from EPA files, which would preclude use of the dispersing agent except as noted in 2003.2-3 for imminent hazards.

2003.3-4 Required Technical Product Data

2003.3-4.1 Name, brand, or trademark, if any, under which the chemical agent is sold.

2003.3-4.2 Name, address and telephone number of the manufacturer, importer or vendor.

2003.3-4.3 Name, address and telephone number of primary distributers or sales outlets.

2003.3-4.4 Special handling and worker precautions for storage and field application. Maximum and minimum storage temperatures to include optimum ranges as well as temperatures that will cause phase separations, chemical changes or otherwise damage effectiveness of the chemical agent.

2003.3-4.5 Shelf Life.

2003.3-4.6 Recommended application procedure(s), concentration(s) and conditions for use depending upon water salinity, water temperature and types and ages of the pollutants.

2003.3-4.7 Dispersant Toxicity—Use standard toxicity test methods described in EPA Report "Standard Dispersant Effectiveness and Toxicity Test" (EPA R2-73-201, May 1973) pages 22-34. This report may be obtained from the Oil and Special Materials Control Division (WH-548), EPA, Washington, D.C. 20460.

2003.3-4.8 Dispersant Effectiveness—Use standard effectiveness test methods in EPA R2-73-201, May 1973, pages 11-21.

2003.3-4.9 Flash Point—Select appropriate method from the following: ASTM—D 56-70; ASTM—D 92-72; ASTM—D 93-72; ASTM—D 1310-67.

2003.3-4.10 Pour Point—Use ASTM D 97-66

2003.3-4.11 Viscosity—Use ASTM D 445-72

2003.3-4.12 Specific Gravity—Use ASTM D 1298-67

2003.3-4.13 pH—Use ASTM D 1293-65

2003.3–4.14 Ionic Activity—Use Weatherburn Test as described below:

Ionic activity tests (Weatherburn Test)

Reagents: 1. Dye solution: 0.03 grams methylene blue, 12 grams concentrated sulfuric acid, 50 grams anhydrous sodium sulfate dissolved in water to make a total of one liter solution.

2. Anionic surfactant solution—0.5% Aerosol OT (Sodium dioctyl sulfo succinate).

3. Chloroform.

Procedure: 1. Into a 25 ml. test tube, place 8 ml. of dye solution and 5 ml. chloroform. Add anionic surfactants solution drop by drop, shaking vigorously between drops and allowing phases to separate. Continue adding dropwise until the two layers are equal in color and intensity viewed in reflected light. Usually 10 to 12 drops of anionic solution are required.

2. Now add 2 ml. of 0.1% solution of the unknown and shake vigorously.

Results: 1. Chloroform phase (lower) is deeper in color and aqueous phase is mostly colorless—anionic is positive.

2. Water phase (upper) is deeper in color than the chloroform phase—cationic is positive.

3. Both phases are more or less the same color—probably a nonionic.

4. If the aqueous phase has become milky and hence slightly lighter in color, it may still be nonionic. Soaps do not react in this procedure. If both anionics and nonionics are present, the reaction of this test will be anionic positive.

2003.3–4.15 Miscibility—Use the test described below which is a modification of military specification MIL–C–22230 (ships):

One part of the dispersing agent is mixed with 100 parts of synthetic sea water. The solution is agitated for one hour and any visible separation of the dispersing agent should be noted after this period of agitation. The test is to be performed with water temperatures at both 20°C and 0°C. The synthetic sea water shall be formulated as follows:

| | |
|---|---|
| Sodium Chloride (grams) | 150.0 |
| Magnesium Chlorids, hexahydrate (grams) | 66.0 |
| Calcium Chloride dihydrate (grams) | 9.6 |
| Sodium Sulfate anhydrous (grams) | 24.0 |
| Distilled water to make a total of (liters) | 6.0 |

2003.3–4.16 Dispersing Agent Components Itemize by chemical name and percentage by weight of each component of the total formulation. The percentages will include maximum, minimum and average weights in order to reflect quality control variation in manufacture or formulations. At least the following major components shall be identified in complying with 2003.3–4.16.

(a) Surface active agents.

(b) Solvents.

(c) Additives.

If requested by the submitter, information from 2003.3–4.16 will be handled as trade secrets under provisions of P.L. 90–23, the Administrative Procedures Act.

2003.3–4.17 Heavy Metal and Chlorinated Hydrocarbons

Using reliable analytical chemistry techniques, state the concentrations or upper limits of the following materials:

Arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, plus any other metals that may be reasonably expected to be in the sample. Atomic absorption methods should be used and the detailed analytical methods and sample preparation shall be fully described:

Cyanide using standard colorimetric procedures:

Chlorinated hydrocarbons. Gas chromatography should be used and the detailed analytical methods and sample preparation shall be fully described.

2003.3–5 Analytical Laboratory Requirements for Technical Product Data:

2003.3–5.1 The required tests shall be performed by a qualified laboratory.

2003.3–5.2 The technical product data submission shall include the identity of the laboratory, the qualifications of the laboratory staff including professional biographical information for individuals responsible for any tests, and laboratory experience with similar tests. Laboratories performing bioassay tests for dispersant or surface collecting agent toxicity must demonstrate previous bioassay experience in order for their results to be accepted. EPA will not approve the selection of laboratories by intended submitters of technical product data prior to submission of the data. It is the responsibility of the submitter to select competent analytical laboratories based on the guidelines contained herein.

2003.3–5.3 EPA reserves the right to refuse to accept a submission of technical product data because of lack of qualifications of analytical laboratory, significant variance between submitted data and any laboratory confirmation performed by EPA, or other circumstances that will result in inadequate or inaccurate environmental information on the dispersing agent.

*2004 Surface Collecting Agent Program for Spills of Oil and Applicable Hazardous Substances*

2004.1 Authorization for Use of Surface Collecting Agents: Major, Medium and Minor Discharges.

2004.1–1 The OSC may authorize use of surface collecting agents on a case-by-case basis when their use will:

2004.1–1.1 Result in the least overall environmental damage or interference with designated water uses, and

2004.1–1.2 Provide a key element in the most effective system for removing oil or hazardous substances discharge from the water environment.

2004.1–2 Mechanism for authorizing use. The OSC may authorize the use of a surface collecting agent verbally when on scene or by telephone prior to arriving on scene. In all cases, the OSC is obligated to comply with the provisions of 2004.2 prior to making such authorization. A review of the capabilities and expertise of the owner or operator or cleanup contractor prior to the occurence of the spill incident would be most beneficial in situations where telephone authorization is desired or contemplated.

2004.2 Restrictions on Surface Collecting Agent Use.

2004.2–1 The OSC may authorize the use of surface collecting agents only after being informed of the environmental conditions at the point of intended use. These environmental conditions include air and water temperatures, wind conditions, wave and current conditions, presence and relative density of debris and other floating matter on the water, type and condition of the oil or hazardous substance spilled, special biological factors such as waterfowl sanctuaries, wildlife refuges, spawning or nursery grounds, shellfish beds, swamp areas, etc., and the availability of removal equipment that could be employed to remove the collected material from the water. Information on environmental conditions should be evaluated by the OSC from the standpoint that conditions such as strong winds, choppy waters, low temperatures, debris, and aquatic vegetation can adversely affect the performance of collecting agents or complicate further removal operations. The performance can also vary with types of oils or hazardous substances. The agents can be effective with thin films of light oils but have little value with thick layers of heavy, viscous oils. The agents should not be used unless adequate removal equipment is available to remove the collected oil.

2004.2–2 A chemical agent shall not be used as a surface collecting agent unless the provisions of 2004.3 are complied with and EPA has informed the manufacturer's representative that the product is acceptable for use as a surface collecting agent.

2004.3 Technical Product Data for Surface Collecting Agents.

2004.3–1 Technical product data as specified in 2004.3–4 shall be provided to the Oil and Special Materials Control Division (WH–548), EPA, Washington, D.C. 20460, at least 60 days prior to the use of the agent. The use of existing surface collecting agents may be authorized by the OSC without complying with 2004.3 for 120 days from the effective date of this Annex. Within 60 days of receipt of the data, EPA will inform, in writing, the submitter on the adequacy of the data submitted. If additional data are requested or EPA desires to perform additional tests, the surface collecting agent may not be used until these additional needs have been satisfied and the submitter so notified.

2004.3–2 Information furnished in accordance with 2004.3–4 shall be maintained on file by the EPA, Oil and Special Materials Control Division (WH–548), Washington, D.C. 20460, to provide technical guidance to OSCs on the acceptable circumstances of use, dosage rates and special problems in the use of surface collecting agent. Any changes in the composition or formulation of the surface collecting agent that will affect any of the data requested in 2004.3 shall be immediately brought to the attention of EPA and testing of the agent will be repeated prior to the use of the revised formulation of the surface collecting agent.

2004.3–3 EPA will review technical product data for surface collecting agents and will issue approvals for agents meeting certain criteria. At present, the only minimum criterion established is for solubility which is described in 2004.13. This criterion classifies the substance as a surface collecting agent but is not an indication of the effectiveness or toxicity of the material. Other product data such as toxicity, chemical components, and

physical characteristics will be reviewed and, if the combined effects of these data and other factors will result in excessive hazard to the aquatic life, work safety, or other elements of the environment in the judgment of EPA, the Agency may refuse to approve the use of the agent.

EPA may, from time to time, establish minimum criteria for the data being requested and may also require additional data to assist in arriving at a judgment on the environmental acceptability of collecting agent usage.

To avoid possible misinterpretation and misrepresentation of the EPA's role in the surface collecting agent technical product data program, the manufacturer's representatives may use only the EPA letter advising compliance with 2004.3–4 in any advertisements or technical literature on the collecting agent. The EPA letter must be used in its entirety. Failure to comply with these restrictions or any other improper reference to EPA in attempting to demonstrate EPA approval of the surface collecting agent beyond that stated in the letter for use on spills of oil or hazardous substances shall constitute grounds for removing the technical product data from EPA files which would preclude use of the surface collecting agent.

2004.3–4 Required Technical Product Data

2004.3–4.1 Name, brand, or trademark, if any, under which the surface collecting agent is sold.

2004.3–4.2 Name, address and telephone number of the manufacturer, importer or vendor.

2004.3–4.3 Name, address and telephone number of primary distributors or sales outlets.

2004.3–4.4 Special handling and worker precautions for storage and field application. Maximum and minimum storage temperature to include optimum ranges as well as temperatures that will cause phase separation, chemcial changes, or otherwise damage effectiveness of the surface collecting agent.

2004.3–4.5 Shelf Life.

2004.3–4.6 Recommended application procedure(s), concentration(s) and conditions for us depending upon water salinity, water temperature and types and ages of the pollutants.

2004.3–4.7 Surface Collecting Agent Toxicity—Use standard toxicity test methods described in EPA Report "Standard Dispersant Effectiveness and Toxicity Test" (EPA R2–73–201, May 1973) pages 22–34. This report may be obtained from the Oil and Special Materials Control Division (WH–548), EPA, Washington, D.C. 20460.

2004.3–4.8 Flash Point—Select appropriate method from the following: ASTM—D 56–70; ASTM—D 92–72; ASTM—D 93–72; ASTM—D 1310–67.

2004.3–4.9 Pour Point—Use ASTM D 97–66

2004.3–4.10 Viscosity—Use ASTM D 445–72

2004.3–4.11 Specific Gravity—Use ASTM D 1298—67

2004.3–4.12 pH—Use ASTM D 1293–65

2004.3–4.13 Interim Test to Distinguish Between Surface Collecting Agents and Other Spill Cleanup Chemicals.

In order to distinguish between surface collecting agents and other chemical materials, this interim test procedure was developed. This test procedure is not an efficiency test. It is to be used only to distinguish between surface collecting agents and dispersants.

*Scope*

1. Procedure to be used to determine the solubility in water under standard conditions of oil spill control chemicals.

*Method Summary*

2. Five (5) milliliters of the chemical under test are intimately mixed with ninety-five (95) milliliters of distilled water, allowed to stand undisturbed for one hour, and then the volume of the upper phase is determined to the nearest 1 milliliter.

*Apparatus*

3. (a) Mixing cylinder, 100 milliliter subdivisions and fitted with glass stoppers.
(b) Pipettes: Volumetric pipette, 5.0 milliliter.
(c) Timers

*Procedure*

4. Add 95 milliliters of distilled water 22°C+/−3°C to a 100 milliliter mixing cylinder. To the surface of the water in the mixing cylinder, add 5.0 milliliters of the chemical under test. Insert the stopper and invert the cylinder 5 times in 10 seconds. Set upright for one (1) hour at 22°C+/−3°C and then measure the chemical layer at the surface of the water. The major portions of the chemical added (75%) should be at the water surface as a separate and easily distinguished layer.

2004.3–4.14 Surface Collecting Agent Components

Itemize by chemical name and percentage by weight each component of the total formulation. The percentages will include maximum, minimum and average weights in order to reflect quality control variations in manufacture or formulations. At least the following major components shall be identified.

(a) Surface active agents
(b) Solvents
(c) Additives

If requested by the submitter, information for 2004.3–4.14 will be handled as trade secrets under provisions of Pub. L. 90–23, the Administrative Procedures Act.

2004.3–4.15 Heavy Metals and Chlorinated Hydrocarbons

Using reliable analytical chemistry techniques, state the concentrations or upper limits of the following materials:

Arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, plus any other metals that may be in the sample. Atomic absorption methods should be used and the detailed analytical methods and sample preparation shall be fully described:

Cyanide using standard colorimetric procedures:

Chlorinated hydrocarbons. Gas chromatography should be used and the detailed analytical methods and sample preparations shall be fully described.

2004.3–5 Analytical Laboratory Requirements for Technical Product Data: Follow stipulations in 2003.3–5

*2005 Biological Additive Program for Spills of Oil and Applicable Hazardous Substances*

2005.1 Authorization for use of biological additives.

2005.1–1 All discharges, the OSC may authorize the use of biological additives on water or shorelines only after obtaining the approval of the EPA representative to RRT. The manufacturer or supplier of microbiological cultures or enzymes must obtain approval from State and local public health and pollution control officials and furnish evidence of such approval to the EPA RRT representative.

2005.2 Special Restrictions on Biological Additive Use

2005.2–1 Microbiological cultures and enzyme mixtures shall not be considered for use as biological additives unless technical product data have been provided and accepted in accordance with 2005.3.

2005.2–2 The OSC must be supplied with the chemical composition and ratios of primary nutrients or nutrient additives prior to seeking approval for their use.

2005.3 Technical Product Data for Biological Additives

2005.3–1 Technical product data as outlined in 2005.3–4 on the constituents of a biological additive shall be submitted to the Oil and Special Materials Control Division (WH–548), Environmental Protection Agency, Washington, D.C. 20460, at least 60 days prior to the use of the additive. Within 60 days of receipt of the data, EPA will inform in writing the submitter on the adequacy of the data provided.

If additional information is requested or EPA desires to perform tests, the biological additive may not be used until the additional needs have been satisfied and the submitter so notified.

2005.3–2 Information furnished in accordance with 2003.3–4 shall be maintained on file by EPA to provide technical guidance to OSCs on the acceptable circumstances of use and application rates for biological additives. Any changes in the composition of the biological additive that will affect any of the data being requested in 2005.3–4 shall be immediately brought to the attention of EPA, and testing of the additive will be repeated prior to the use of the revised biological additive.

2005.3–3 The acceptance and maintenance of product data by EPA does not constitute approval of the biological additive nor does it imply compliance with any EPA criteria or minimum standards for such additives. The OSC will determine which biological additive may be used for a spill event on a case-by-case basis using all available information in making such a decision. To avoid possible misinterpretation and misrepresentation of EPA's role in this technical product data program, the manufacturer's representatives may use only the EPA letter advising compliance with 2005.3–4 in any advertisements or technical literature on the biological additive. The EPA letter must be used in its entirety. Failure to comply with these restrictions or any other improper reference to EPA in attempting to demonstrate EPA approval of the biological

additive for use on spills of oil or hazardous substances shall constitute grounds for removing the technical product data from EPA files which would preclude use of the biological additive.

2005.3–4 Required Technical Product Data

2005.3–4.1 Name, brand, or trademark, if any, under which the biological additive is sold.

2005.3–4.2 Name, address and telephone number of the manufacturer, importer or vendor.

2005.3–4.3 Name, address and telephone number of primary distributors or sales outlets.

2005.3–4.4 Special handling and worker precautions for storage and field application. Maximum and minimum storage temperatures.

2005.3–4.5 Shelf Life.

2005.3–4.6 Recommended application procedure(s), concentration(s) and conditions for use depending upon water salinity, water temperature and types and ages of the pollutants.

2005.3–4.7 Statements on the expected effectiveness of the additive including degradation rates and the test conditions and data on effectiveness.

2005.3–4.8 For microbiological cultures furnish the following information:

Listing of all microorganisms to species,[1]

Percentage of each species in the composition of the additive,[1]

Optimum pH and temperature range for use of the additive,

Special nutrient requirements, if any,

Separate listing of the following and test methods for such determinations: Salmonella, fecal coliform, Shigella, Staphylococcus Coagulase positive, and Beta Hemolytic Streptococci.

2005.3–4.9 For enzyme additives furnish the following information:

Enzyme name(s),

International Union of Biochemistry (I.U.B.) number(s),

Source of the enzyme,

Units,

Specific Activity,

Optimum pH and temperature range for the use of the additive.

2005.3–5 Laboratory Requirements for Technical Product Data: Follow stipulations in 2003.3–5.

*2006 Burning Agent Program for Spills of Oil and Applicable Hazardous Substances*

2006.1 Authorization for Use of Burning Agents

2006.1–1 All discharges. The OSC may authorize the use of burning agents only when they will:

2006.1–1.1 Prevent or substantially reduce imminent threats to human life, limb, or property;

2006.1–1.2 Result in the least environmental harm when compared to other removal or disposal methods.

2006.1–2 Prior to authorizing use under 2006.1–1.2, the OSC must obtain approval of the EPA RRT representative and all applicable State and local public health pollution control officials.

2006.2 Special Restrictions on Burning Agent Use

2006.2–1 The OSC will evaluate the suitability of burning agents on a case-by-case basis. Burning agents should be inert materials that will not, in themselves, be a water pollutant. The addition of oils (such as gasoline or solvents) as an igniter shall be avoided unless it is necessary under 2006.1–1.

2006.2–2 A technical data program for burning agents will not be established at this time.

*2007 Sinking Agent Program for Spills of Oil and Applicable Hazardous Substances*

2007.1 Authorization for Use of Sinking Agents

2007.1–1 All Discharges

Sinking agents shall not be applied to discharges of oil or hazardous substances on the navigable water of the United States or the contiguous zone.

*2008 Mechanical Methods and Sorbents Program for Spills of Oil and Hazardous Substances*

2008.1 Authorization for Use of Mechanical Methods and Sorbents

2008.1–1 All Discharges

2008.1–1.1 As stated in 2001.3, it is the policy of this Schedule to favor the use of mechanical methods and sorbents for removal of oil and hazardous substances spills. The OSC has the authority to use or prohibit specific mechanical methods and sorbents on a case-by-case basis. The OSC will select methods and materials that, in his judgment, will be most effective in expeditiously removing the spilled material and mitigating the related damages, and will minimize secondary pollution from the removal or mitigation operation. Prior to authorizing the use of sorbents, the OSC shall take into consideration hydrographic and meteorological conditions as well as the characteristics of the sorbent and the availability of adequate containment and removal equipment.

2008.1–1.2 A technical data program for mechanical methods and sorbents will not be established at this time.

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[1] If requested by the submitter, these items will be handled as trade secrets under the provisions of the Administrative Procedures Act (Pub. L. 90-23).

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MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
DIRECTORATE OF FISHERIES RESEARCH

# FISHERIES RESEARCH TECHNICAL REPORT No. 57

## Research into toxicity evaluation and control criteria of oil dispersants

M.G. NORTON and
FRANCES L. FRANKLIN

LOWESTOFT, 1980

Table 1 - Sea test results

| Type | Dispersant | Mean mortality (%) Method 1 (oil & dispersant premixed before addition to test tanks) | | Method 2 (dispersant added to oil film before agitation) | |
|---|---|---|---|---|---|
| | | Oil alone | Oil and dispersant | Oil alone | Oil and dispersant |
| Conventional (hydrocarbon solvent-based dispersants) | Agma EP 540 | – | – | 5 | 0 |
| | Ameroid Oil Spill Dispersant/LT | 60 | 65 | – | – |
| | Applied 8-40 | – | – | 80 | 20 |
| | Atlan'tol 3211 | – | – | 70 | 90* |
| | Atlan'tol 3211/E | – | – | 80 | 5 |
| | BP 1100X | 65 | 45 | 10 | 10 |
| | Corexit 8354 | 60 | 35 | – | – |
| | Dasic Slickgone LT2 | 40 | 35 | 10 | 15 |
| | Emkem Spillwash LT | 35 | 30 | – | – |
| | Emulsol LW | 40 | 15 | – | – |
| | Finasol OSR-2 | 60 | 60 | – | – |
| | Finasol OSR-3 | – | – | 70 | 15 |
| | Fleetex BD/3 | 60 | 25 | – | – |
| | Gamlen OSR LT 126 | 60 | 45 | – | – |
| | Kraken MC 563 | 65 | 35 | – | – |
| | Lankromul OSD | 65 | 65 | – | – |
| | Petrocon Oil Spill Eliminator IV | – | – | 5 | 15 |
| | Rochem Oil Spill Remover (WSA) | – | – | 10 | 10 |
| | Servo CD 2000 | – | – | 5 | 5 |
| | Shell Dispersant LTX | 35 | 35 | – | – |
| | Teklene TC-48 | – | – | 40 | 45 |
| | Wellaid 311 | – | – | 65 | 95* |
| | X-3125 | – | – | 5 | 15 |
| Concentrates (tested as a 10% solution in sea water) | Agma EP 559 | – | – | 5 | 15 |
| | Atlan'tol AT7 | – | – | 55 | 80 |
| | Atlan'tol AT7 floating | – | – | 40 | 55 |
| | Compound W1911 | – | – | 10 | 20 |
| | Compound W1986 | – | – | 10 | 5 |
| | Corexit 7664 | – | – | 10 | 65* |
| | Corexit 9527 | 25 | 90* | 30 | 75* |
| | Corexit 9600 | 40 | 70 | 55 | 70 |
| | Dasic Slickgone LTD | 85 | 95 | 20 | 40 |
| | Finasol OSR-5 | 35 | 95* | 20 | 70* |
| | Finasol OSR-7 | – | – | 70 | 80 |
| | Gamlen Oil Dispersant LT | 50 | 60 | 55 | 75 |
| | IMX 103 | – | – | 60 | 45 |
| | Leek A | – | – | 45 | 80* |
| | Leek B | – | – | 30 | 65* |
| | Nokomis-3 Conc. | 50 | 70 | 20 | 25 |
| | Quell - Oil CI | 60 | 75 | 55 | 80 |
| | Seawash | – | – | 15 | 15 |
| | Shell Dispersant Concentrate | 60 | 90 | 30 | 55 |
| | Spillaway | – | – | 35 | 30 |
| | Surflow OW1 | 50 | 70 | 55 | 95 |
| | Synperonic OSD 20 | 45 | 55 | 55 | 60 |
| | Synperonic OSD 41 | – | – | 80 | 85 |
| | Value 100 | – | – | 50 | 50 |

*Significant increase in toxicity (Student's t-test, $P = \leq 0.05$)

which were significantly more toxic than physically-dispersed oil. Concentrate dispersants usually produced a dispersion which appeared to have a toxicity greater than the oil alone but only in five cases was this increase in toxicity statistically significant (Student's t-test; $P = <0.05$).

3.2 Tests under non-standard conditions

In order to validate the test procedure used for licensing purposes, experiments were conducted to determine the sensitivity of the test to variations in test conditions. These are described in Sections 3.2.1 - 3.2.8.

3.2.1 *Effectiveness of physical dispersion*

Although every effort was made to form a reproducible dispersion of oil by physical means, the degree to which the oil was mechanically dispersed by the propeller action tended to vary between the test tanks. In Table 2 a subjective assessment based on a visual observation of the degree of dispersion is compared with the mean mortality (%) in a series of 284 test tanks. These data suggest a strong link between the subjective assessment of the degree of dispersion and its toxicity. The 'poor' dispersions were characterised by coarse oil droplets and thus a low oil/water surface area; the 'good' dispersions by fine droplets and a larger oil/water surface area. The suggested association between the degree of dispersion and toxicity may be due *inter alia* either to the differences in oil droplet size (perhaps affecting its availability to the organism) or to enhanced dissolution of soluble oil fractions across the increased oil/water interface.

A simple experiment was conducted to determine whether finer dispersions were associated with increased amounts of oil in solution. For this purpose 12 tanks were set up under standard test conditions; oil was added to six tanks already subject to agitation (as in Method 1 in Section 2.2) and to another six tanks before agitation was started (Method 2, in Section 2.2). The degree of dispersion was varied within each set of six replicates and assessed at the end of the 100 min exposure period. At the end of the experiment a sample of the oily water from each tank was filtered through a Whatman No. 1 filter paper and the filtrate analysed for 'dissolved' oil by UV fluorescence spectrophotometry. The results (Table 3) showed that the finer dispersions using Method 1 were accompanied by an increase in the concentration of oil in solution. No such clear relation was obtained with Method 2, mainly because no 'poor' or 'very good' dispersions were observed. The concentration of the water-soluble fraction of oil required to cause mortality of a range of species during a 96 h exposure period was found by Rice *et al.* (1976a, b) to be in the range 1.8-10.8 $\mu l\ l^{-1}$. In the sea test animals were exposed only for 100 min, and it appears unlikely that the concentration of the water-soluble fraction was responsible for the difference in toxicity observed; it seems likely that droplet size was a more important factor.

Regardless of the cause of the change in toxicity, it is clear that variability in the degree of dispersion of the physically-dispersed oil in the control can markedly influence mortality. In order to minimise this possibility and to ensure consistency of standard test conditions, results of tests in which the oil dispersion appears to be exceptionally poor or variable are discarded.

3.2.2 *The relationship between dispersion characteristics and toxicity*

To investigate further the relationship between the droplet size of the dispersed oil and the toxicity of the dispersion, a limited number of tests were carried out in which some of the characteristics of the oil dispersions produced by both methods of dispersant application were investigated. The standard test conditions were used for these experiments with analyses of water samples taken from the centre of the tanks during the 100 min exposure period. The size distribution of the oil droplets in suspension in the oil and dispersant mixtures was measured using a Coulter counter with 200 $\mu$m aperture. Although the Coulter counter determinations were carried out immediately

**Table 2 - The relationship between extent of dispersion and toxicity of physically-dispersed oil in the sea test**

| Dispersion description (visual observation) | Method 1 (oil added to tanks with agitation) | | Method 2 (oil added to tanks before agitation) | |
|---|---|---|---|---|
| | Number of observations | Mean mortality (%) | Number of observations | Mean mortality (%) |
| Very poor | – | – | 5 | 10 |
| Poor | 14 | 35 | 32 | 15 |
| Fair | 26 | 55 | 86 | 35 |
| Good | 22 | 55 | 91 | 45 |
| Very good | 1 | 70 | 7 | 55 |

Table 3 - The relationship between extent of dispersion, concentration of oil in solution and toxicity of physically-dispersed oil in the sea test

| Dispersion description (visual observation) | Method 1 (oil added to tanks with agitation) | | Method 2 (oil added to tanks before agitation) | |
|---|---|---|---|---|
| | 'Dissolved' oil ($\mu l\ l^{-1}$ Kuwait oil equivalents) | Mortality (%) | 'Dissolved' oil ($\mu l\ l^{-1}$ Kuwait oil equivalents) | Mortality (%) |
| Poor | 0.5 | 65 | – | – |
| Fair | 0.8 | 70 | 0.7 | 35 |
| | | | 1.0 | 50 |
| Good | 1.3 | 50 | 1.0 | 50 |
| | 1.2 | 55 | 0.6 | 55 |
| | 1.0 | 65 | 1.1 | 55 |
| | | | 1.2 | 70 |
| Very good | 2.5 | 70 | – | – |

after sampling, it was not possible to measure the droplet size distribution of the physically-dispersed oil using this method because of the instability of the oil droplets. The concentration of physically and chemically-dispersed oil present in each tank was also measured by ultra-violet fluorescence spectrophotometry.

The results of these experiments are given in Figure 3. For each treatment, the mortality resulting from addition of dispersant to an oil film (Method 2) was less than that resulting from addition of the premixed oil and dispersant (Method 1). For two of the three concentrate dispersants this reduction in toxicity was accompanied by an increase in the mean droplet size of the dispersed oil. There also seemed to be an inverse relationship between droplet size and toxicity when Method 1 (premixing) was used for all three concentrate dispersants. Although there was an empirical link between increased droplet size and reduced toxicity it is possible that the Coulter counter itself may have modified the size distribution of the dispersed oil droplets or that this distribution could have changed between being sampled from the test tanks and analysed on the Coulter counter. In this case the larger droplet size when Method 2 (dispersant added to oil film before agitation) was used could be due to the production of a less stable dispersion in which some degree of droplet coalescence occurred before analysis.

The concentration of oil dispersed by each method and dispersant was similar; such differences that did occur may have been caused by the difficulty of sampling through a surface oil film, especially in the oil only tanks. There was no obvious relationship between the concentration of dispersed oil and toxicity.

An attempt was also made to determine the cause of death of the shrimps in the test. The two principle effects of acute poisoning by oil are chemical toxicity (in which the oil hydrocarbons disrupt cellular or subcellular functions) and physical impairment (in which epithelial cells are coated and the animals are deprived of oxygen) (Moore and Dwyer, 1974). Nelson-Smith (1972) suggested that the constituents of dispersants could increase the uptake of oil components and Anderson *et al.*(1974a, b) obtained evidence that the soluble aromatics of an oil were responsible for most of its toxic effects. Samples of shrimps from some of the oil and dispersant tanks were analysed at the end of the 24 h recovery period for naphthalene and its $C_1$-, $C_2$- and $C_3$- derivatives by the technique of mass fragmentography (Law, 1978a). Concentrations of these compounds in the tissues of the shrimps which survived the experiments (0.3-0.8 $\mu l\ l^{-1}$ total naphthalenes) appeared to be greater than those in shrimps which had died (0.1-0.3 $\mu l\ l^{-1}$). It is therefore unlikely that ingestion of these or related chemicals was responsible for the mortality. A microscopic examination of the dead shrimps revealed small oil droplets in the gill cavity and a coating of oil on the mouthparts and in the stomach. Little difference was observed between the shrimps exposed only to oil and those exposed to oil chemically-dispersed. It therefore seemed possible that shrimps were killed by physical processes, such as suffocation due to the mechanical clogging or damage of respiratory surfaces. These effects have been noted by other workers (Nelson-Smith, 1972; McKeown and March, 1978).

The experiments reported here have shown that the toxicity of the oil in the sea test is dependent upon a number of factors. A more precise determination of the individual contribution of each of these factors towards the toxicity of an oil or oil-dispersant dispersion was not possible during these studies which dealt mainly with the validation of test procedures.

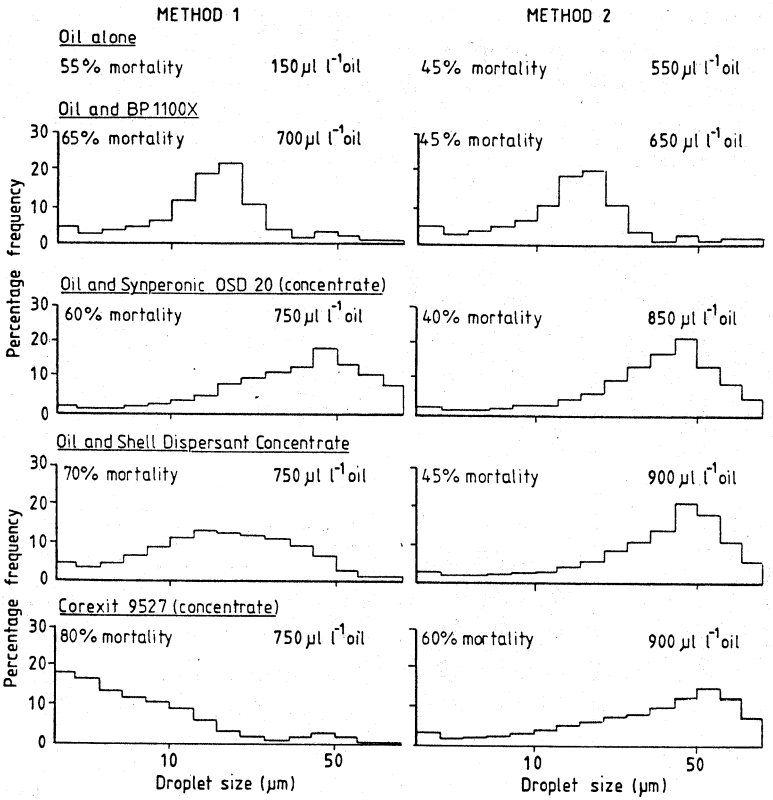


**Figure 3.** *Crangon* mortality, oil concentration and droplet size distributions of five oil/dispersant mixtures (mean of four replicate tests).

Method 1 – Oil and dispersant premixed before addition to test tanks.
Method 2 – Dispersant added to oil film before agitation.

3.2.3 *Variations in the sensitivity of shrimps to oil*

The response of *Crangon* to the physically- and chemically-dispersed oil was found to vary between tests. Figure 4 shows the variation in mean mortality of shrimps caught at various times in 1976, 1977 and 1978 and exposed to physically-dispersed oil, together with the temperature of the estuary water when the animals were caught. No clear seasonal or temperature-related change in sensitivity is apparent; the increased resistance during the late summer in 1976 and 1977 was not observed in 1978. The short-term fluctuations which occurred during this period may be due to the condition of the animals, the stage of breeding cycle or the extent and method of handling before testing. As the sensitivity of the test animals varies between tests and the toxicity of different batches of the standard oil may vary, it is essential to compare simultaneously the toxicity of a dispersant/oil mixture with that of the physically-dispersed oil using the same stock of test animals. Within each set of replicate tests the values of the standard error are low enough to allow the detection of differences of toxic effect between dispersants.

3.2.4 *Effect of changes in the degree of agitation*

The speed of the motors operating the stirrers used in the standard test was chosen as 1350-1450 rpm because this produced a uniform and reproducible dispersion without causing the test organisms stress (Section 2). Table 4 shows that when the motor speeds were reduced by half there was a reduction in toxicity of the physically-dispersed oil and a less significant decrease in the toxicity of the oil and dispersant mixture, reflecting the lower mixing energy in the system. The relative toxicities of the dispersions obtained using the four dispersants remained unchanged at the lower speed. Because of the absence of mortality in the control tanks where the oil was poorly dispersed at the lower speeds, however, the toxicity of the chemically-dispersed oil became of greater statistical significance. Thus, where tests are carried out for licensing purposes which involve a pass-fail limit (Section 1), it is essential to standardise the degree of agitation by use of a fixed motor speed.

3.2.5 *Effect of changes in the source of oil*

All the results presented so far have been obtained using fresh Kuwait crude oil, but as part of the validation programme a number of standard sea tests have also been carried out using two fresh North Sea crude oils. The results of tests using fresh and 'weathered' Kuwait, Ekofisk and Auk oils, both alone and with four reference dispersants are shown in Table 5. Differences in toxicity between the oils were reflected in the relative toxicities of the oil and dispersant mixture. Thus, the oil selected for the test did not affect the identity of the dispersants exhibiting the greatest and lowest toxicity. A comparison of the results for fresh and 'weathered' oil showed that, although 'weathering' reduced the toxicity of the oil and the oil/dispersant mixtures, their relative toxicities remained the same.

The tests which produced the results in Table 5 were carried out over a period of 1 year and the difference in toxicity between the oils could have been affected by the various factors listed in the previous section. To enable a direct comparison of the relative toxicities of the oils, a single test was carried out in which a physical dispersion of all three oils, both fresh and 'weathered', were tested simultaneously using the same batch of shrimps. The results from this test, which are presented in Table 6, suggest that Auk oil is the most toxic of the three to shrimps.

Exposure of fresh oil to air for only 24 h results in a significant reduction in its toxicity and it is essential that standard oils be stored in small airtight containers which are discarded after opening. This practice has been adopted with the Kuwait oil used for the standard test. Moreover, the contents of one of these cans has been analysed by gas liquid chromatography every month to determine whether any

**Table 4 - Effect of reducing the degree of agitation on results of sea tests using four dispersants**

| Motor speeds (rpm) | Dispersant | Mean mortality (%) | |
|---|---|---|---|
| | | Oil | Oil and dispersant |
| 1350-1450+ | BP1100X | 10 | 10 |
| | Synperonic OSD 20 | 55 | 60 |
| | Shell Dispersant Conc. | 30 | 55 |
| | Corexit 9527 | 30 | 75* |
| 500-800 | BP1100X | 0 | 0 |
| | Synperonic OSD 20 | 0 | 10 |
| | Shell Dispersant Conc. | 0 | 15* |
| | Corexit 9527 | 0 | 55* |

*Significant increase in toxicity (Student's t-test; $P = < 0.05$).
+As used in standard test (Section 1.3.1)

simulate field trials the dispersant was applied to the oil by means of sprayers similar to those used in the beach test. Because of the difficulty of adjusting the sprayers to deliver an accurate quantity of dispersant directly onto the oil in the tanks, the nominal dispersant to oil ratios of 1:10 and 1:20 are only approximate and no statistical analysis can be performed on individual results. However, there is some suggestion that the use of neat concentrates may generate a slightly more toxic dispersion than the diluted dispersant.

## 4. Beach test results

### 4.1 Tests under standard conditions used for licensing purposes

The results of beach tests with a number of dispersants using the standard test conditions as described in Section 2.3 are given in Table 10. In the series of tests reported, exposure of the limpets to fresh Kuwait crude oil caused mortalities of between 30% and 95%, and application of dispersant led to a wider range of mortalities, varying from

Table 10 - Beach tests results

| Type | Dispersant | Mean mortality (%) | |
|---|---|---|---|
| | | Oil | Dispersant |
| Conventional (hydrocarbon solvent-based) dispersants | Agma EP 540 | 40 | 40 |
| | Ameroid Oil Spill Dispersant/LT | 65 | 25 |
| | Applied 8-40 | 65 | 70 |
| | Atlan'tol 3211 | 65 | 100* |
| | Atlan'tol 3211/E | 65 | 100* |
| | BP 1100X | 35 | 15 |
| | Corexit 8354 | 65 | 95* |
| | Dasic Slickgone LT2 | 80 | 35 |
| | Emkem Spillwash LT | 80 | 75 |
| | Emulsol LW | 80 | 60 |
| | Finasol OSR-2 | 65 | 85* |
| | Finasol OSR-3 | 65 | 90* |
| | Gamlen OSR LT 126 | 65 | 85* |
| | Kraken MC 563 | 80 | 50 |
| | Lankromul OSD | 80 | 55 |
| | Petrocon Oil Spill Eliminator IV | 40 | 95* |
| | Rochem Oil Spill Remover (WSA) | 50 | 55 |
| | Servo CD 2000 | 45 | 60 |
| | Shell Dispersant LTX | 80 | 70 |
| | Teklene TC48 | 45 | 20 |
| | Wellaid 311 | 35 | 100* |
| | X-3125 | 45 | 60 |
| Concentrates (tested as a 10% solution in sea water) | Agma EP 559 | 40 | 75* |
| | Atlan'tol AT7 | 65 | 95* |
| | Atlan'tol AT7 Floating | 35 | 100* |
| | Compound W 1911 | 50 | 80* |
| | Compound W 1986 | 50 | 100* |
| | Corexit 7664 | 50 | 10 |
| | Corexit 9527 | 45 | 70* |
| | Corexit 9600 | 95 | 90 |
| | Dasic Slickgone LTD | 95 | 45 |
| | Finasol OSR-5 | 80 | 90* |
| | Finasol OSR-7 | 66 | 22 |
| | Gamlen Oil Dispersant LT | 80 | 30 |
| | IMX-103 | 55 | 50 |
| | Leek A | 60 | 30 |
| | Leek B | 60 | 20 |
| | Nokomis-3 Conc. | 80 | 65 |
| | Quell Oil CI | 95 | 55 |
| | Seawash | 50 | 65 |
| | Shell Dispersant Concentrate | 50 | 15 |
| | Spillaway | 35 | 100* |
| | Surflow OWI | 80 | 40 |
| | Synperonic OSD 20 | 40 | 50 |
| | Synperonic OSD 41 | 30 | 20 |
| | Value 100 | 65 | 5 |

*Mortality significantly greater than oil control (Student's t-test; $P = <0.05$)

5% to 100%. About one third of the dispersants tested were significantly more toxic than oil, with little difference between conventional dispersants and concentrates.

4.2 Tests under non-standard conditions

As with the sea test, the sensitivity of the test to variations in test conditions has been investigated and the influence of several variables is described below (Sections 4.2.1-4.2.4).

4.2.1 *Variations in the sensitivity of limpets to oil*

Some indication of the variation of sensitivity of limpets to oil was obtained by examination of the mean mortality (%) of limpets exposed to oil during beach tests carried out in 1977 and 1978 (Figure 5). It is apparent that limpets are slightly less sensitive to the toxic effects of oil during the summer months and that the short-term fluctuations in mortality are low. The standard deviations within each set of replicate tests are low enough to allow detection of differences, between the toxic effects of oil and those of dispersants, with some confidence.

4.2.2 *Effect of changes in the source of oil*

Approval of a dispersant for licensing purposes is based on its toxicity relative to that of a standard oil; thus variations in toxicity between oils could lead to different results. The sensitivity of limpets to three oils is shown in Table 11 where the toxicities of Auk and Ekofisk oils, both fresh and 'weathered', are compared with that of the standard Kuwait oil using two batches of limpets. There appeared to be no significant difference in toxicity between the different types of oil, or between fresh and 'weathered' oil. These results suggested that a coating of oil will result in similar mortalities regardless of the exact concentration or composition of the oil, and imply that the limpets were killed by being physically coated with oil, rather than because of chemical toxicity. The detailed mechanism by which the oils used in these tests exerted their effects on limpets is not clear.

**Table 11 - Relative toxicities of three oils, both fresh and 'weathered' to two populations of limpets in the beach test**

| Type of oil | Mean mortality (%) | | |
|---|---|---|---|
| | Kuwait | Ekofisk | Auk |
| Fresh | 50 | 50 | 45 |
| | 45 | 45 | 35 |
| 'Weathered'+ | 35 | 60 | 55 |
| | 40 | 50 | 40 |

+Fresh oil exposed to air as a 10 mm film for 24 h

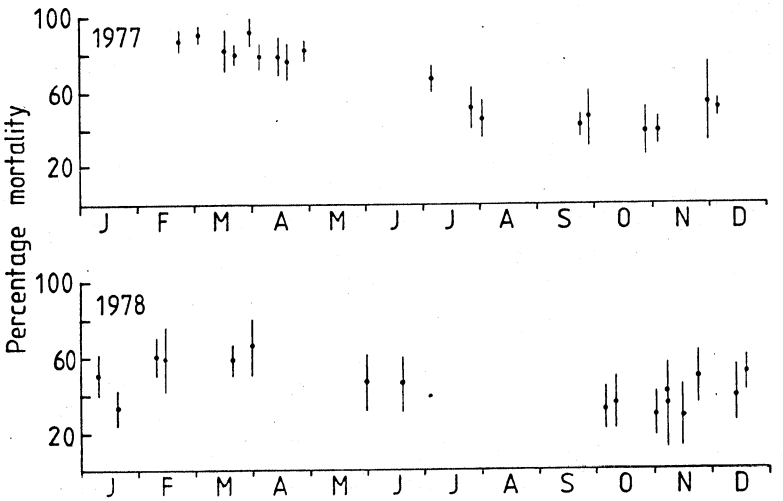


Figure 5. Seasonal variations in the mortality of *Patella* exposed to fresh Kuwait crude oil under standard beach test conditions.

Mean % mortality and standard deviation.

4.2.3 *Effect of changes in the application rate of oil and dispersant*

To determine the effect on limpets of changing the application rates used in the test, each of the reference dispersants and the standard oil were tested at three different application rates using the same batch of limpets. The results, presented in Table 12, show that a 75% reduction of the application rate of oil caused no significant reduction in the mortality of limpets in the test, consistent with the suggestion earlier that limpet mortality from oil is primarily due to physical rather than chemical processes. Dispersant toxicity does however, decrease as the application rate is lowered; thus the number of dispersants passing the test (Section 1.4) was dependent on the application rate used in the test. In the standard tests this was set at the average rate used in practice ($0.4\ l\ m^{-2}$) (Section 1.3.2). These test results, however, show that the danger of damage to intertidal organisms can be reduced if dispersants are used at low rates of application. To avoid increasing the damage already being caused by the oil spilt on the shores, dispersant should always be used at the minimum application rate which results in effective removal of the oil.

4.2.4 *Effect of applying dispersant to oiled limpets*

Although the standard test is based on a comparison of the toxicities of oil and dispersant to limpets, in a clean-up operation already-oiled organisms will be sprayed with dispersant. The additional effect of dispersants on oiled limpets was thus determined using the four reference dispersants (Table 13). In each case the mortality of oiled limpets sprayed by dispersant was significantly higher than that of limpets exposed to oil or dispersant alone; this suggests that under most circumstances, the toxic effects of oil and dispersant are additive. A comparison of the effect of dispersant on oiled limpets with the effect of oil alone could thus not be readily used for regulatory purposes. Nevertheless, of the reference dispersants, those with a lower toxicity to unoiled limpets also cause the smallest increase in mortality when sprayed on oiled limpets. Thus the effect of restricting licences to products having a low toxicity under the standard beach test conditions also minimises the adverse effects of oil-dispersant mixtures on organisms.

Table 12 - Effect of different application rates on results of beach tests using four dispersants

| Application rate of oil and dispersant ($l\ m^{-2}$) | Dispersant | Mean mortality (%) | |
|---|---|---|---|
| | | Oil | Dispersant |
| 0.4 + | BP 1100X | 35 | 15 |
| | Synperonic OSD 20 | 40 | 50 |
| | Shell Dispersant Conc. | 50 | 15 |
| | Corexit 9527 | 45 | 70* |
| | Mean | 40 | 40 |
| 0.2 | BP 1100X | 40 | 15 |
| | Synperonic OSD 20 | 40 | 30 |
| | Shell Dispersant Conc. | 25 | 15 |
| | Corexit 9527 | 50 | 45 |
| | Mean | 40 | 25 |
| 0.1 | BP 1100X | 40 | 5 |
| | Synperonic OSD 20 | 25 | 15 |
| | Shell Dispersant Conc. | 25 | 5 |
| | Corexit 9527 | 40 | 40 |
| | Mean | 35 | 15 |

*Mortality significantly greater than oil control (Student's t-test; $P = <0.05$)
+Rate used in standard test (Section 1.3.2)

Table 15 - Concentrations of oil in the water column resulting from natural and chemical dispersion at sea

| Details of spill | Type of oil (and dispersant) | Maximum oil concentration ($\mu l\ l^{-1}$) | Source |
|---|---|---|---|
| *Natural dispersion* | | | |
| ARROW, Chedabucto Bay, USA April 1970 | Bunker C fuel oil | 0.06 | US Ministry of Transport, 1970 |
| AMOCO CADIZ, Brittany March 1978 | Light Iranian and Arabian crudes | 0.2 (offshore) | Law, 1978b |
| DRUPA, Norway February 1976 | Iranian crude | 0.2-0.3 | Grahl-Nielsen *et al.*,1978 |
| Ekofisk Bravo blowout, North Sea, April 1977 | North Sea crude | 0.3 | Grahl-Nielsen, 1978 |
| Experimental 14 t slick | Heavy gas oil | 1.5 | Cormack and Nichols, 1977b |
| Experimental 7 l enclosed slick | North Sea crude | 0.15 | Ward and Davies, 1978 |
| Experimental ½ t slick | North Sea crude | 2.5 | Cormack and Nichols, 1977b |
| ELENI V, North Sea May 1978 | Heavy fuel oil | 3.4 (inshore)<br>0.04 (offshore) | Law and Hall, 1978 |
| Picnic Bay, Hong Kong November 1973 | Heavy marine diesel | 0.06 | Spooner, 1977 |
| *Chemical dispersion* | | | |
| ELENI V, North Sea May 1978 (near wreck) | Heavy fuel oil + Dasic Slickgone LTD | 0.2 | Law and Hall, 1978 |
| DRUPA, Norway | Iranian crude + Finasol OSR 2 | 1 | Grahl-Nielsen *et al.*,1978 |
| Experimental 230 l slick | Fresh Kuwait crude + BP 1002 | 48 | Cormack and Nichols, 1977b |
| Experimental 7 l enclosed slick | North Sea crude + BP 1100X | 78 | Ward and Davies, 1978 |

to the concentrations which have been shown to be encountered *initially* following dispersion of a slick. Where the less toxic dispersants are used, the 100 min LC50 value is substantially higher than concentrations actually measured under a chemically-dispersed slick.

Observations at sea have demonstrated that subsequent dilution is rapid; in Cormack's (1977) studies, the maximum concentration of chemically-dispersed oil fell from 48 $\mu l\ l^{-1}$ after 2 min to below 2 $\mu l\ l^{-1}$ after 100 min. Therefore dilution during the first 100 min is likely to reduce the dispersed oil concentration to between 0.01 and 0.001 of the 100 min LC50 value where the less toxic products are used. Weathering of fresh oil which is likely to occur before spraying with dispersant will also tend to reduce the toxicity of the dispersed oil. Thus, provided marine organisms are not exposed repeatedly to concentrations of dispersed oil and provided there is adequate water

U.S. ENVIRONMENTAL PROTECTION AGENCY,
OFFICE OF ENFORCEMENT,
*Washington, D.C., September 26, 1980.*

Hon. GERRY E. STUDDS,
*Chairman, Oceanography Subcommittee, Committee on Merchant Marine and Fisheries, House of Representatives, Washington, D.C.*

DEAR MR. CHAIRMAN: In my recent testimony before the Oceanography Subcommittee, Congressman Breaux asked a number of questions concerning the burden of proof under section 403(c) of the Clean Water Act (the Act). Specifically, does EPA or the applicant for an National Pollutant Discharge Elimination System (NPDES) permit determine the degradation to the marine environment as a result of the proposed discharge?

Section 403(c)(1) of the Act directs the Administrator of EPA to promulgate ocean discharge guidelines to be used in determining the degradation of marine waters when issuing an NPDES permit. Section 403(c)(2) prohibits the issuance of an NPDES permit for an ocean discharge in cases in which there is insufficient information on the proposed discharge to make a reasonable judgment on the guidelines. The permitting authority must make the determinations called for by section 403(c). The real question, however, is where the law places the burden of presenting sufficient information to that authority to allow the "reasonable judgment" required by the Act.

EPA's Consolidated Permit Regulations, 45 FR 33290 (May 19, 1980), based on the Administrative Procedure Act, place the ultimate burden of persuading the Agency that an NPDES permit should be issued upon the permit applicant. The permit applicant bears this burden not only in its application for a permit but also in any subsequent envidentiary hearing on the permit. This means that the permit applicant should be prepared to submit sufficient information to support a determination to issue the permit.

Once a permit is issued, that permit, or any of the conditions contained in that permit may be challenged in an evidentiary hearing. When a permit condition is challenged in an evidentiary hearing, EPA bears the burden of going forward to present an affirmative case in support of the challenged permit condition. The permit applicant, or any other hearing party, who contends that the issuance or denial of a permit is improper or invalid, or who challenges the inclusion or deletion of specific permit conditions, has the burden of going forward to present an affirmative case at the conclusion of the Agency's presentation.

The ultimate burden of persuading the Agency to issue an NPDES permit, however, remains at all times on the permit applicant. This is particularly true in the case of an application for an NPDES permit for an ocean discharge because of the requirement in section 403(c)(2) that no permit be issued for such a discharge without sufficient information on which to make a reasonable judgment concerning the effects of the proposed discharge.

I hope this satisfactorily answers Congressman Breaux' question. A similar letter has been sent to Congressman Breaux. Please let me know if I may provide the Subcommittee additional information.

Sincerely yours,

R. SARAH COMPTON,
*Deputy Assistant Administrator*
*for Water Enforcement.*

Mr. STUDDS. The subcommittee will be adjourned.
[The following was received for the record:]

CONGRESS OF THE UNITED STATES,
HOUSE OF REPRESENTATIVES,
*Washington, D.C., September 4, 1980.*

Ms. R. SARAH COMPTON,
*Deputy Assistant Administrator, Office of Water Enforcement, Environmental Protection Agency, Washington, D.C.*

DEAR MS. COMPTON: As a result of your testimony and response to questions at hearings held by the Oceanography Subcommittee of the House Merchant Marine and Fisheries Committee, I would appreciate your responding to the additional questions listed below.

(1) Would you please supply this Committee with the raw data only from the EPA study on the effects of drill muds in the Gulf of Mexico, at your earliest convenience?

(2) During your appearance, you stated that the study of the studies by Rice University was flawed because, I believe you stated, there was no baseline information available on the Gulf of Mexico. My questions are:

(a) Would you say those studies are irrelevant as to the impacts of drilling muds and other commercial activities on the OCS? If so, why, and if not, why?

(b) If the Rice and other studies are flawed because of the lack of baseline information, what impact does this have upon EPA's studies referred to in testimony before this Committee?

(3) Are you prepared to state that any scientific study conducted under anything other than actual operating conditions could prove conclusively that there is or is not significant harm to marine biology from any OCS commercial activity?

(4) Do you feel that applying these standards (i.e., conclusively proving no significant harm) to all uses of the oceans would be proper?

(5) Can you supply this Committee with empirical evidence or research findings of the negative impacts of commercial activities (other than oil and gas) in the marine environment?

(6) Would you mind telling this Committee if there is any research conducted under actual operating conditions on the OCS that you feel is relevant and that proves conclusively that there is or is not any significant negative impact to fisheries from commercial usage of the oceans?

(7) Can you prove conclusively through research (without actually allowing events to continue until there is a significant negative impact) that oil and gas activities, commercial fishing, the dumping of dredge spoil or other commercial uses of the oceans will not have any significant negative impact on the marine biology?

(8) In your statement, and in your response to questions, you expressed deep concern over providing adequate protection for the marine environment against harm from oil and gas operations, as is the case with all commercial activities I am sure, by using the regulatory authority you have by law. There is no reason this should be doubted, nor disagreed with.

In response to a question by Mr. Breaux, you also stated, and agreed with the Secretary of the Interior Andrus, that there was adequate authority in law to provide for the safety necessary for the resources in the Georges Bank and as a matter of fact, you agreed that neither EPA nor Interior were permitting any activity that posed a foreseeable significant adverse impact to fisheries or any other resources on the OCS. In light of this, do you feel that there is more that should or could be done that is allowed or is not allowed by law to protect the marine biota?

(9) Is there any level of commercial uses of the oceans at which you could say conclusively there will not be any foreseeable significant harm to the marine biology? If so, what is that level, and how could it be accomplished?

(10) What is the scientific difference and relationship between "proving conclusively there will be harm" and "proving conclusively there will not be harm"? How does this difference relate to the modeling, conclusion, and usage of research as well as to its relevance?

(11) What is the relationship and significant difference between scientifically proving there "will be no foreseeable harm," and "there will be foreseeable harm"? What is the relevance of each?

(12) What do you feel would be the impact of additional legislation, such as is being considered, to provide another layer of legal requirements to protect commercial fishing in the Georges Bank area from oil and gas operations, in light of the fact that EPA and DOI say that they have the legal authority to protect against foreseeable harm to fisheries and other marine resources?

(13) Is the phrase "harm to the marine biology" necessarily significant as pertains to a negative impact on the marine environment?

(14) Is the phrase "harm to the marine biology" necessarily a relative or significant finding as pertains to significant negative impact on commercial fishing?

(15) In EPA's experience, have long-term biological effects of suspected toxic substances been substantiated when short-term effects were not detected?

(16) Upon what evidence does EPA base the conclusion that the Georges Bank is more ecologically sensitive than the Gulf of Mexico?

(17) What areas onshore or offshore are now approved for disposal of drilling muds? What is the procedure for obtaining approval of such dump sites and what period of time is required to obtain approval? If needed, can EPA assure, without question, that such approved sites will be established?

(18) Did the EPA participate in developing the protocol for conducting bioassays on drilling muds? Has an acceptable protocol been established which can be generally used by all laboratories?

We would appreciate your responses to these questions at your earliest convenience.

Sincerely,

EDWIN B. FORSYTHE.

[Responses to the foregoing questions had not been received at time of publication.]

[Whereupon, at 12:50 p.m. the subcommittee adjourned.]