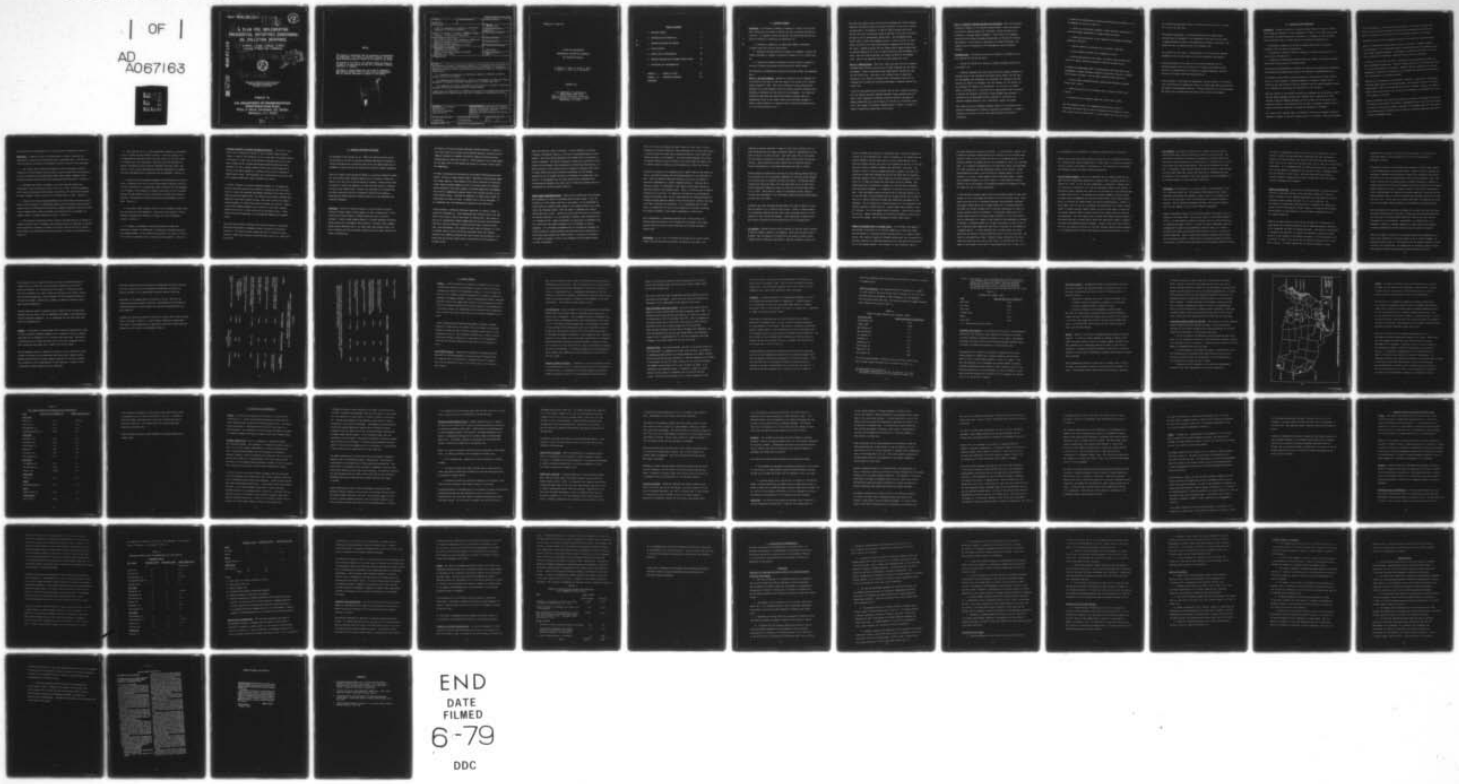
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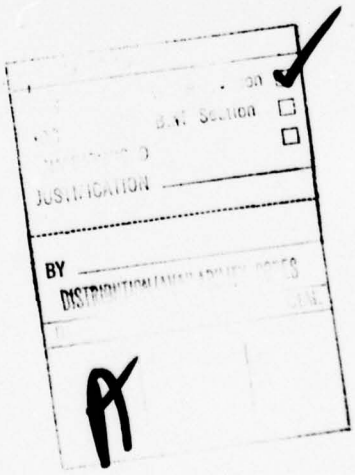
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16. Abstract

The President's message to Congress on March 17, 1977 outlined major initiatives to be taken to achieve the goal of reducing maritime oil pollution. In response to these initiatives the Coast Guard carried out a series of studies to investigate the feasibility of:

1. Developing a capability to effectively respond to pollution incidents within 6 hours of notification;

2. Developing and maintaining an inventory of equipment to permit the Federal Government to respond to pollution incidents of up to 100,000 tons, and

3. Improving the Federal Government's overall ability to respond to pollution incidents particularly during periods of severe weather.

A Task Force was established to integrate the results of the studies that developed the feasibility of meeting these goals and to formulate an implementation plan.

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A PLAN FOR IMPLEMENTING PRESIDENTIAL INITIATIVES CONCERNING OIL POLLUTION RESPONSE

J. Valenti; J. Leigh; G. Marsh; R. Ross;
J. Kuchin; G. Mucci and J. Bellantoni

OCTOBER 1978

U.S. DEPARTMENT OF TRANSPORTATION
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1. EXECUTIVE SUMMARY

BACKGROUND. The President's message to Congress on 17 March 1977 outlined major initiatives to be taken to achieve the goal of reducing maritime oil pollution. In response to these initiatives, the Coast Guard carried out a series of studies to investigate the feasibility of:

1. Developing a capability to effectively respond to pollution incidents within six hours of notification,

2. Developing and maintaining an inventory of equipment to permit the Federal Government to respond to pollution incidents of up to 100,000 tons, and

3. Improving the Federal Government's overall ability to respond to pollution incidents, particularly during periods of severe weather.

The findings and recommendations resulting from these studies are summarized below:

GOAL #1 - SIX HOUR RESPONSE. Adequate oil pollution control equipment can be delivered in six hours to meet the threat of oil spills in U.S. coastal waters projected to 1985. This can be achieved by siting personnel and equipment at the most probable locations of major pollution incidents and by employing a combination of land, water and air transport. The volume and conditions under which past spills have occurred indicate that each geographical region of the country should have sufficient equipment to permit a rapid response, on a regional level to cope with discharges of up to a few million gallons of oil.

The resulting response system gives six hour coverage with varying response capability weighted according to the spill potential of the area to twenty-six major ports. The potential in 1985 for spills greater than 50,000 gallons (162 tons) in these port areas is expected to vary from five spills per year to one in approximately eleven years. The recommended system should achieve a mean value response time of 2.2 hours to spills in these areas, with 99.5% of all such spills having a response time of less than six hours. Adequate coverage over the coastal area in general should also be achieved because 81.6% of all oil ports having an annual throughput of at least 1,000 tons (308,000 gallons) are within six hours of the proposed sites. None of the remaining 18.4% are located beyond ten hours.

GOAL #2 - MASSIVE SPILLS. Since 1967, there have been only four incidents worldwide where 100,000 or more tons of oil were dicharged into the marine environment. Three of these spills were approximately 100,000 tons, and one was 220,000 tons. The threat of an incident of such a magnitude occurring in U.S. waters is increasing due to economics of scale of oil transport which dictate the continuing replacement of smaller tankers with larger ones.

A study of past massive spills indicates that the total inventory resulting from the regional pollution response equipment levels proposed above will permit timely responses to potential and actual pollution incidents of massive proportions up to and including the 100,000 ton (30,800,000 gallon) goal. The success of individual response efforts, however, is subject to certain limitations as described in this report.

GOAL #3 - IMPROVING RESPONSE EQUIPMENT AND TECHNIQUES. There are functional limitations inherent in the proposed response system. Some exist because of a need for improved operational techniques, limited availability of information, or proper support equipment. Others result from equipment limitations which require engineering application of research and development efforts. A final group of limitations are natural constraints that probably cannot be surmounted by any developmental efforts presently foreseen.

RECOMMENDATIONS. The following actions are required to implement the six hour response and 100,000 ton goals:

o Procure the $32.8M of oil pollution response equipment specified in this report, and

o Establish Emergency Port Task Forces and locate response equipment at fourteen sites in the contiguous forty-eight states (Boston, MA; New York, NY; Philadelphia, PA; Portsmouth, VA; Clearwater, FL; Pascaguola, MS; New Orleans, LA; Sabine, TX; Galveston, TX; Port Aransas, TX; Los Angeles, CA; San Francisco, CA; Seattle, WA; and Chicago, IL), as well as in Alaska, Hawaii, and Puerto Rico. A one-time cost of approximately $13M is required to procure and construct facilities to house equipment and personnel. A recurring cost of approximately $10M is required to provide for the necessary response personnel (333), maintenance, support and upkeep.

The capability of the recommended response system can be improved by more effective implementation of existing technology and procedures. A number of advances in the state of the art also appear feasible and should be considered.

To improve the implementation of existing technology and procedures, it is recommended that action be taken to:

- o Obtain an international agreement to make technical information for performing damage assessments on tankers readily available.
- o Assure the availability of tank vessels for offloading and recovery operations ($300,000).
- o Improve operational techniques for oil recovery ($600,000).
- o Insure adequate availability of dispersants ($1.2M).
- o Develop characteristics for future, and modify existing Coast Guard cutters to support marine environmental protection program ($8.5M).

A research and development effort of approximately $4.4M per year is also recommended to support necessary advances to the state of the art in dealing with pollution incidents. The principal programs involve efforts to:

- o Improve vessel assessment/salvage capabilities/offloading equipment ($6.9M, over 5 years).
- o Improve the ability of oil recovery units to function ($8.9M, over 5 years).
- o Develop Arctic/ice response capability ($4.9M, over 5 years).

Over the immediate future, the recommended program should result in techniques that permit state of the art recovery units to function in from five to seven foot wind driven seas. It would appear that over the long run,

the proposed program might be able to extend the state of the art to recover oil in up to ten foot seas.

The expected improvements in offloading operations will enable heavy residual fuels to be pumped in cold temperatures, provided that the safety of response personnel would not be jeopardized by existing conditions. This capability does not generally exist at the present time.

The program will also result in modifications to state of the art response equipment so that it may be used in arctic and sub-arctic environments.

While many advances to the state of the art may be expected from the proposed program, there will continue to be occasions when severe weather conditions, considerations for the safety of response personnel, and other factors will prohibit effective response efforts.

Costs contained in this report are approximate, and are stated in 1978 dollars. Final determinations of expenditure levels will require more detailed acquisition, and research and development planning. Locations identified for siting equipment may require minor changes when more detailed site surveys are developed.

2. INTRODUCTION AND METHODOLOGY

BACKGROUND. A number of pollution incidents occurred during the winter of 1976-77 which caused the President to issue a message on 17 March 1977 in which he outlined initiatives for reducing maritime oil pollution. In response to this, the Coast Guard conducted a number of study efforts to determine the feasibility of:

- o Developing a capability to be able to respond effectively to pollution incidents within six hours of notification.
- o Maintaining a sufficient amount of equipment to be able to cope with an oil spill of up to 100,000 tons.
- o Improving the Coast Guard's overall ability to respond to pollution incidents, particularly during periods of extreme weather.

A Task Force was established to integrate the results of the studies that determined the feasibility of meeting these goals and to formulate an implementation plan.

For purposes of this report, when the location of the pollution incident dictates that air or land transport of response equipment is required, response time is defined as the time required to deliver equipment from the nearest equipment storage site (timewise) to the staging site designated for the incident.

When the location of the incident indicates that equipment can be delivered by water from the nearest equipment storage site, response time is defined as the time required to deliver response equipment from the storage site to the scene of the pollution incident. Time delays have been included in estimated response times to account for briefing personnel, and preparing equipment for transport.

The initial 6 hour response effort is intended to deliver the equipment considered necessary to permit an effective response action to be mounted. Additional equipment

would be delivered on a continuing basis as required. It must be recognized that there will be occasions when weather conditions and considerations involving the safety of personnel will preclude the use of equipment delivered to the scene.

The general contents of the subsequent sections of the report are outlined below:

Section 3 evaluates the current state of the art of pollution response equipment and techniques. It also identifies specific problem areas that have limited the success of past response operations. The prognosis for extending the state of the art and for reducing or eliminating, operational restrictions is considered.

In Section 4, the criteria utilized for determining the geographical locations for siting equipment are developed. The spill threat potential for the various ways that oil is moved and produced is discussed. Expected 1985 spill potentials for various geographical locations are indicated, as is the method for developing and evaluating site configurations for equipment storage.

Massive spill considerations are discussed in Section 5. This section reviews past worldwide massive spills from various sources. Most probable locations for massive spills based on 1985 oil flow projections are also discussed. Finally, the types of massive spills which might occur, as well as the operational requirements which they would impose, are outlined.

Section 6 develops the criteria for determining the amount of equipment which should be located at each specific site within a geographical region, and within the country as a whole. This section includes a discussion of equipment levels for both massive and non-massive spill responses, and the need for establishing Emergency Port Task Forces at recommended sites.

The conclusions and recommendations of the Task Force are summarized in Section 7.

METHODOLOGY. A general outline of the steps taken in order to determine the feasibility of achieving the above stated goals is presented below. The section in which the specific procedures are discussed is shown at the end of each paragraph.

a. The historic spill rates were estimated at various geographic locations throughout the United States from the records of spills greater than 50,000 gallons for all oil production and transportation modes (tank vessels, deepwater ports, lightering vessels, pipelines and Outer Continental Shelf activities). (Section 4)

b. Estimates were made of the amount of oil that would be produced and transported by each of these activities in the U.S. in 1985. Using the estimated spill rates and projected activity levels, the potential for spills was determined for each geographic location along the U.S. coastal waters in 1985. (Section 4)

c. Locations for siting response equipment were then generated by placing equipment as close as possible to geographical areas having the greatest spill potential. Locations were also determined by identifying acceptable debarkation points from which a major response effort could be launched, and selecting sites to encompass the greatest number of possible debarkation points. (Section 4)

d. The resulting configurations were critically evaluated against one another by comparing the mean value of response time, expected fraction of responses to most probable locations for incidents in excess of six hours, and the fraction of historic spills greater than 50,000 gallons occurring within six hours of the proposed sites. (Section 4)

e. Past major spills of oil and those having a potential for discharge of up to 100,000 tons were studied in detail. From this analysis, the circumstances and expected outflow rates most likely to occur as a result of a massive spill were determined. Scenarios were then developed for massive discharges at those locations considered to be more likely than others, so that, overall offloading and recovery requirements for general and worst case massive spill situations could be estimated. (Section 5)

f. Existing pollution response equipment and techniques were critically rated to determine their utility under various expected weather conditions so that the potential for success under these conditions could be estimated. In this manner, it was possible to identify those state of the art systems showing the most promise as well as the levels of success which could be expected. The process also identified areas where improvements could be made. (Section 3)

g. The levels of most promising state of the art equipment needed within each site area were then determined. Levels were then adjusted to reflect equipment available from commercial, private, and other governmental sources. (Section 6)

h. A research, development, testing and evaluation program was formulated to support the development of operational techniques and equipment deemed necessary to fill existing deficiencies in the state of the art and for which a reasonable level of success could be expected. (Section 3)

NATIONAL INVENTORY OF RESPONSE EQUIPMENT/CAPABILITY. The intent of this effort was to determine the extent to which a Federal response system capable of dealing with discharges of oil in open water environments should be developed to insure that the Presidential response goals would be met. Beach cleanup was not included because past experiences indicated that a commercial oil spill cleanup industry existed that could be expected to provide a near shore capability, including a work force for cleaning up impacted shore areas. Past experience also indicated that very little open water response capability existed throughout the country.

A national inventory of pollution response equipment in the commercial, private, and public sectors was conducted in conjunction with this study effort to insure that response requirements developed by the study did not duplicate existing capabilities. The results of this effort indicated that commercial and private cleanup concerns, have large inventories of beach cleanup equipment and harbor boom located throughout the country. However, little harbor skimming capability and virtually no open water response capability were found to exist outside of the government sector. These results have been incorporated in the recommended response and equipment levels.

The Coast Guard intends to maintain the national inventory to facilitate obtaining large amounts of equipment during a discharge of significant proportion. The system has been computerized and is currently accessed through 53 remote data terminals located throughout the U.S. at Coast Guard field units.

3. RESPONSE TECHNIQUES AND SYSTEMS

The purposes of this section are to: define the limiting factors on the various state of the art oil pollution response techniques and systems; to discuss the feasibility of improving state of the art capabilities; and to recommend a course of action for improving the existing response capability.

There are normally three operational phases to a pollution response incident. The first actions taken, whenever possible, are to attempt to reduce the amount of oil that will be spilled during an incident. Steps are then taken to prevent or control the spread of oil which has been spilled to minimize the size of the effected area. Finally, the contained oil is removed from the water surface with the aid of mechanical devices called skimmers. Techniques for redistributing or breaking down the oil are sometimes used instead of skimming.

OFFLOADING. Actions to reduce the amount of oil which might be spilled during an incident usually involve pumping oil from a ruptured tank or from a sound tank to help refloat a stranded vessel and avoid a pollution incident. A ship's normal pumping system or a portable emergency offloading system may be used to accomplish this objective. Although a ship's pumping system usually operates eight to ten times faster than portable units, the ship's installed unit may be rendered inoperative by the vessel casualty and cannot be counted upon.

An analysis of existing portable offloading systems performed in support of this study identified the Coast Guard-developed emergency offloading system, commonly referred to as ADAPTS, and similar commercial systems as being representative of the state of the art. These systems are air transportable, and can pump 1,000 to 2,000 gallons per minute of a typical crude at moderate temperature.

Two basic limitations are involved with the portable offloading units themselves. The use of larger tankers makes it desirable to have portable pumps with higher capacity. There appears to be little likelihood for developing higher capacity portable pumps that will fit through normal tank openings. Another problem is that heavy residual oils become essentially non-pumpable when cooled to temperatures normally found in the northern portions of the country during winter. Although the capability to handle large volumes of cooled heavy oils does not exist, it appears that it can be developed. It is recommended that this development be pursued by the Coast Guard.

A major problem in conducting offloading operations is finding a vessel to receive the offloaded oil. Past experiences have indicated that it can take from 12 to 30 hours to find a tank vessel to offload into. While state of the art air transportable rubber bladder bags can hold about 247,000 gallons (823 tons), they are difficult to handle and too small to serve as other than a stop gap measure. This problem can most likely be reduced on a local or regional level by having the Federal government enter into standing contracts with commercial operators that would insure the availability of an ocean going tug and tank vessel within a short period of time whenever an incident occurs.

Where such contracts cannot be obtained, it may be necessary to provide lightering (offloading) capacity in the form of government-leased or owned vessels. This would require maintenance and support funds, and possibly a capital investment. The capital costs may be reduced by utilization of tank vessels from the reserve fleet maintained by the Maritime Administration. A detailed survey of these vessels would be required to determine their state of repair before they could be seriously considered for this purpose. Although the use of standby contracts is considered to be potentially less costly it is recommended that the Coast Guard further investigate both alternatives and implement the latter only if sufficient coverage cannot be accomplished by executing standby contracts.

VESSEL DAMAGE ASSESSMENT/SALVAGE. Several major problems may be encountered when attempting to offload a distressed and/or leaking vessel. First the integrity of a tank vessel, even one in good repair, can be jeopardized if liquid loads are removed without regard to the stresses placed on the vessel during the unloading process. When the vessel is damaged, such actions become even more critical. Unless the ship's plans and stability information are readily available, it is not possible to develop a safe offloading plan in a minimum of time. There are presently no regulations or agreements that will insure that the needed information will be available in time of emergency. It is therefore recommended that an international agreement be sought through the Intergovernmental Maritime Consultative Organization to have tanker owners deposit the required data at a location to be named by the country of registry, so that, the information can be accessed rapidly in times of emergency.

Even if the above improvements are made, cases will occur when it will be necessary to consider offloading a small percentage of the cargo (jettisoning) to quickly remove the vessel from a precarious position, either before offloading can begin to be completed. This would become necessary when either the weather conditions and/or integrity of the ship caused the vessel to be in imminent danger of breaking up and discharging its cargo into the sea.

Decisions to jettison or to temporarily put a vessel firmly on the bottom, so that it can better withstand the forces being placed on it are difficult to make. They are presently made more difficult by the lack of a method to make quick assessments of a vessel's damaged condition. Likewise, once a decision is made, its implementation may require laying heavy moorings or performing equally time consuming tasks. There is a definite need to improve capabilities in this area. As required by the National Oil and Hazardous Substance Contingency Plan, the U.S. Navy Supervisor of Salvage provides the necessary salvage expertise needed to deal with pollution incidents involving tank vessel groundings and strandings. It is recommended that the Coast Guard, in cooperation with the U.S. Navy Supervisor of Salvage, accomplish the research necessary to make needed improvements in these areas.

Since improvements in offloading operations have a good potential for further reducing the amount of oil entering the environment, the highest priority should be given to action items that will improve offloading capabilities.

CONTAINMENT. An oil slick is contained through the use of floating fences (booms) that protrude above and beneath the surface of the water. The

comparative analysis performed in support of this study indicated that the Coast Guard-developed Open Water Containment System is representative of the state of the art in open water boom. Open water tests with oil have shown that this boom is functional in five-foot seas, 20-knot winds, and one-knot currents. Recent qualitative tests indicate that the boom may actually function satisfactorily in sea states approaching ten feet in height.

Ongoing research indicates that there may be a sea condition beyond which all of the spilled oil will be naturally dispersed into the water column because of the mixing which is caused by wind and wave action. Preliminary results indicate that mixing may begin with wind driven seas as low as three feet, and be essentially complete for most oils when the wind driven seas exceed 10 to 12 feet. These results, though of a preliminary nature, appear to indicate that improvement in oil containment capabilities beyond approximately ten foot seas is unlikely.

Techniques have been developed whereby booms can be used to deflect or slow down the spread of oil in areas of fast current. There is limited prospect of a significant breakthrough that would enable individual booms to be more effective in fast current environments. Other approaches for dealing with fast current conditions are being pursued and will be discussed below.

OIL RECOVERY. Recovery actions involve removing oil from the water's surface by devices commonly referred to as skimmers. While there are many kinds of skimmers, they can generally be divided into two groups in terms of their intended mode of operational application. Some are intended to recover oil

from a thickened pool created by a containment boom. Others are designed to function on the unconfined slick. There is presently no one skimmer than can perform optimally over the wide range of oils and conditions that occur. There are several recovery units that can be expected to function in five foot seas and currents or speeds of advance less than about 1-1½ knots. The analysis of state of the art skimmers performed to support this study indicated than an open water skimming device that the Coast Guard is presently developing appears to have a better potential for being successful in recovering oil in higher sea states than other state of the art systems. This system essentially incorporates a skimmer into the open water containment booms previously discussed. It is expected to function in up to five foot seas. Since qualitative testing indicates that the boom may function in up to ten foot seas it may be possible that the skimming barrier can be made to function in similar conditions provided safe operational procedures can be developed. Two tow vessels and a storage container for the recovered oil are needed to operate a skimming barrier. Another vessel may be needed to tend the container. All of the vessels would be required to function with control at one knot. Support requirements are therefore considered to place limitations on this system. This is discussed in further detail below.

VESSEL OF OPPORTUNITY SKIMMING SYSTEM (VOSS). A new concept that appears to hold promise of providing an oil recovery capability in higher sea states involves mounting a relatively portable skimming device on a vessel of opportunity. This vessel of opportunity skimming system would then incorporate the desirable features of a seaworthy platform and the ready mobility and flexibility of the skimmer package. This concept is in the conceptual design or

prototype demonstration stage at this point. It is anticipated, however, that a system can possibly be developed that will function in up to ten-foot seas. Although a VOSS will not encounter as much oil as a skimming barrier, it is uncertain whether the skimming barrier can be adapted for use in up to ten-foot seas. It is therefore recommended that the Coast Guard pursue the development of a VOSS in parallel with the operational testing of the barrier. Unless prearrangements are made to place fittings on selected vessels, it will be difficult to initiate a rapid response around a VOSS-type system. Further, using unprepared vessels will tend to result in a less efficient recovery operation due to the necessity of formulating makeshift arrangements to adapt the vessel for use in recovery operations.

A large dedicated skimming vessel would be the ultimate concept for open water recovery of oil in the highest sea state in which a slick might exist. Such a vessel would have to be an extremely seaworthy, self-contained, relatively high speed, manned vessel with a primary mission of oil response operation. Any number of recovery concepts could be used and considerable on board oil storage capacity could be incorporated. A significant constraint of this design concept would be its limited range of operation. This would necessitate the acquisition of a number of such vessels if wide geographical coverage is desired. A dedicated vessel has the same limitations as a VOSS in that it has a relatively small sweep width over which to encounter oil as compared to a skimming barrier. It would therefore have to either travel at a higher speed than the barrier or require additional time to cover the same area. The latter is considered more likely. Because of these limitations, the anticipated high life cycle cost, and the fact that it is unlikely that oil will remain on the surface of the water in seas greater than 10 to 12 feet, it is

not recommended that development of a dedicated recovery vessel be undertaken.

Whether the ultimate open water recovery unit proves to be a sweeping-type barrier or a different type recovery system used in a VOSS, there is a need for obtaining an ability to store a large amount of recovered oil. The resolution to this problem was addressed earlier for tanker offloading operations.

TOW AND SUPPORT VESSELS. There is an important need for vessels having very low speed towing and maneuvering capability to support either a skimming barrier or to function as a VOSS. As will be shown subsequently, a response to a massive spill will require the availability of a large but reasonable number of such vessels. A preliminary survey indicates that there is a low availability of this required type of vessel around the U.S. The problem may be reduced somewhat by having standby contracts and/or arrangements with regional fishing fleets, tugs, offshore supply boats, and the Navy for vessels having the required characteristics. However, it would appear that the only way to guarantee the availability of at least a nominal number of suitable recovery support vessels, will be to take steps to insure that the greatest possible number of Coast Guard boats and vessels have the necessary characteristics. This will require that the Coast Guard modify existing vessels, to the extent practical, and specifically design new construction vessels to support the marine environmental protection program. Further, these units must routinely train for this mission to provide for efficient recovery operations when necessary. It is recommended that the Coast Guard pursue the above outlined lines of action.

FAST CURRENTS. The existing limitations for recovery units functioning in areas of high current may be significantly raised in the near future. The Coast Guard is presently constructing a prototype oil recovery vessel which was shown to have the potential for recovering oil in currents of up to eight knots during full scale mockup testing. This device is designed for harbor use. If successful, these recovery devices should be placed in areas throughout the country where fast current conditions and oil transportation exist. An extension of this concept to open water situations is also recommended, if it proves successful in river and harbor conditions.

DISPERSANTS. An alternative to oil spill recovery is redistribution of the oil in the water and/or air. The potential effectiveness of the various distribution techniques was examined in detail, since it is recognized that there will be times when it will not be possible to accomplish mechanical recovery. The most promising dispersal technique, from a purely technical point of view, appears to be the use of chemical dispersants.

Chemical dispersants remove oil from the water surface and suspend it as tiny droplets in the water column. This usually results in diminished movement of the oil. It also presents a greater oil surface area for naturally occurring oil degrading microbes to work on. The use of chemical dispersants might be contemplated to protect an environmentally sensitive area, or to reduce a potential fire hazard, when weather conditions make the use of oil recovery devices impossible. There is controversy regarding dispersant effectiveness and the ecological effects of adding them to an already stressed environment. This problem is currently being addressed by the Environmental Protection Agency.

The stocks of dispersants currently within the U.S. are believed to be quite limited. Further, although application techniques have been developed for spraying from surface vessels, and from both helicopter and fixed winged aircraft, there are few vessels and aircraft within the U.S. that can be used to spray dispersants. It is recommended that the Coast Guard either stock or arrange for a minimum amount of dispersants to be stocked, so that, an adequate supply will be available in time of need. The Coast Guard should also modify a sufficient number of vessels and aircraft to insure that it will be possible to spray dispersants when necessary.

WEATHER CONSIDERATIONS. The fact that fifty-five percent of historical spills, resulting in sixty-five percent of the total spill volume have occurred in winter, indicates that any response system must have some potential for being successful between November and March if it is to be effective. For this reason, an investigation was carried out to determine the frequency and length of winter storms passing through a region, or conversely the frequency and persistence of seas favorable to the most weather dependent portion of the response operation.

Based on the above state of the art review, exclusive of ice conditions, it would appear that offloading operations can be undertaken whenever conditions do not jeopardize the safety of response personnel. The period of time required to accomplish the operation, can however, be expected to increase in direct relation to the severity of the weather encountered. Recovery operations will be limited, at least in the near future, to wind driven seas of five to seven feet in height. It further appears that it should be possible to spray

dispersants in any weather in which an oil slick exists. The limiting sea state would appear to be approximately a six foot wind driven sea for mechanical recovery.

The greatest potential for winter pollution incidents in the 48 states, exists in the northeast sector of the United States. Because of this, an analysis was performed to determine the persistence of waves with a significant wave height of less than six feet for selected points along the North Atlantic coast. The results indicate that an average duration of weather favorable to recovery of slightly less than 70 hours can be expected, with 34% of the periods of favorable weather exceeding this time. A "weather window" of this size is considered to offer a good potential for carrying out recovery operations. Since this is the average weather window, it must be recognized that periods of less than 70 hours will also occur. As the size of the window diminishes, the potential for carrying out a successful response operation can be expected to diminish rapidly.

While the potential for pollution incidents can be shown to be much less along the Pacific Northwest and in the Gulf of Alaska than along the Northeast Coast, the conditions in the North Pacific Coast will often be such that recovery operations will not be possible. Nevertheless it is believed that it is necessary to maintain a recovery capability in these areas so that whatever recovery is permitted by weather conditions can be carried out promptly.

There are a number of locations in the country where winter temperatures will quickly cool unheated oil to the point where it can no longer be pumped. As previously stated, there is a high potential that an improved capability to pump cooled oil can be developed. Low temperatures are therefore viewed as slowing down operations rather than prohibiting them from being carried out.

The influence of ice in varying forms of an oil spill recovery operation is complex and can be dealt with only by specific discussion of the various possible situations. For the purpose of this report, it suffices to state that while conditions will tend to confine the spilled oil by natural containment and retard evaporation, the time frames over which response actions can be taken will expand. Recovery will, however, be made more difficult and on some occasions impossible.

Although there are specific equipment needs to support Arctic and sub-arctic response, existing state of the art equipment would appear to have application through engineering adaptation. It is recommended that the Coast Guard take action to accomplish this.

SUMMARY. In conclusion, it would appear that the existing limitations on state of the art pollution response equipment can be extended, so that oil recovery operations can be conducted in up to ten-foot wind driven seas. Preliminary investigations also indicate that most oils will be fully dispersed into the water column when sea states are in excess of 10 feet in height.

For the immediate future, it appears that state of the art recovery units can be made to function in up to seven-foot wind driven seas. Weather windows between winter storms in the most probable locations for pollution incidents can be expected to be of approximately 70 hours duration, a period in which considerable recovery operations can be undertaken.

Offloading operations may be slowed down by temperature when heavy residual fuels are involved, but can be undertaken provided that the safety of response personnel is not jeopardized by existing weather conditions.

Regardless of the advances made to the state of the art, there will be occasions when adverse weather conditions, considerations for the safety of response personnel, and other factors will prohibit response efforts from being effective.

A summary of the funding required to perform the various action tasks outlined above is included in Table 3.1. Dollar figures indicated are approximate 1978 costs. Final determination of expenditure levels will require detailed acquisition, and research and development planning.

TABLE 3.1

SUMMARY OF PROJECTED COSTS FOR ADVANCING THE STATE OF THE ART POLLUTION RESPONSE TECHNIQUES AND SYSTEMS

Project	Time to Complete	Potential for Success	Anticipated Costs ($000's)
Seek international agreement to make tanker information available during emergencies	5 years	Good	3,000 (international economic impact)
Establish standby contracts for tugs and tank vessels	1 year	Good	300 - annually
Utilize MARAD reserve fleet as standby tank vessels	2 years	Good	to be determined
Improve vessel damage assessment/salvage* capabilities/offloading equipment	2 - 5 years	Fair - Good	6,900
Advance sea state in which oil recovery* units will function			
a) Sweeping barrier	3 years	Good	1,700
b) Vessel of Opportunity Skimming System	5 years	Good	2,600
Execute standby contract for support vessels	1 year	Poor - Unlikely to accomplish country-wide	to be determined

TABLE 3.1 (Continued)

Project	Time to Complete	Potential for Success	Anticipated Costs ($000's)
Modify Coast Guard cutters to provide support to recovery operations	3 years	Good	7,500
Develop characteristics needed for future Coast Guard cutters to be able to support marine environmental program	5 years	Good	1,000
Insure adequate stock of dispersants available	2 years	Good	1,200
Modify Coast Guard vessels and aircraft* to spray dispersants	2 - 5 years	Good	1,200
Develop Arctic/ice response capability*	3 - 5 year	Poor - Fair	4,900

*Times and cost noted are for completion of Research and Development. Establishing general operational capability for successful technology would require an additional 1 to 4 years and additional funding.

4. SITING CRITERIA

GENERAL. Several analyses were conducted to determine how to proceed in selecting locations to site equipment in order to meet the six-hour response goal stated in the Presidential message. It can be argued that the only way to achieve a six-hour response is to blanket the coast with equipment and standby personnel. Initial investigations however, indicated that many areas of the country have little or no oil production or traffic. From the information derived below it can be shown that the possibility of a pollution incident of a significant size is several orders of magnitude less in these areas than in areas where oil is routinely handled in or on water.

Siting configurations were therefore developed to achieve a six-hour response in those areas of the country that can be shown to be the most probable locations for major pollution incidents, rather than for every geographical location. The resulting configuration is shown to provide significant response coverage over a large number of the geographical areas were oil pollution incidents of significance can be expected to occur.

SPILL THREAT ANALYSIS. Analyses were performed to determine the spill potential for various geographical locations around the United States. To accomplish this it was necessary to determine the spill potential that could be expected for each of the various modes of oil production and transport.

Data for spills greater than or equal to 50,000 gallons were utilized in determining the spill threat. This was primarily done to insure that the spill potentials derived would approximately reflect the potential for spills of a significant size. A subsequent investigation of the distribution of spills from 10,000 to 50,000 gallons indicated that the spill threat in the various regions is similar for both segments of the spill distribution. The results of these analyses follow:

PORT OPERATIONS. Earlier studies of spill data postulated a relationship between spill rate and the volume of petroleum going in and out of a specific area (throughput). This throughput and spill relationship was tested for data on discharges greater than 50,000 gallons for the years 1974-77. The results obtained suggest that, on the average, the number of spills greater than 50,000 gallons that can be expected to occur in an area in a year is equal to about 0.031 V per million tons, where V is the annual throughput in millions of tons through the area. Observed variances in the nominal spill rate further indicate that the extremes of differences between predicted and observed numbers of spills are about plus or minus one or two spills over the range of individual port throughput that can be expected. At existing throughput rates, approximately 22 spills greater than 50,000 gallons can be expected to occur in the U.S. this year (1978).

TRANSIENT TANKERS AND BARGES. In addition to the spill potential related to petroleum flow in or out of a given location, each area is subjected to a further threat as a consequence of petroleum movement via transient tankers and barges en route to or from destinations outside the area.

Review of existing data indicates that the expected rate for spills greater than 50,000 gallons from this source is about 0.000245 spills per million transient tons.

This is more than two orders of magnitude below the nominal spill rate associated with throughput. Spills from this source are therefore not considered to be of importance for the purpose of this study.

OUTER CONTINENTAL SHELF WELL FIELDS. Spills can also result from the numerous oil wells located along the Outer Continental Shelf (OCS). U.S. Geological Survey data indicate the potential for spills as a result of OCS activities is 0.027 V per million tons (MT). This is comparable to the nominal spill rate of 0.031 V/MT. The potential threat from OCS production can be put in better perspective if one notes that while the spill rates per million tons of throughput are comparable, the total OCS production for any one year through 1990 is not expected to exceed 117 MT, or approximately 1/7 of the total waterborne petroleum throughput in the study region for the year 1977 alone.

DEEPWATER PORTS. With few exceptions, the ports of the United States are not deep enough to accommodate very large crude carriers. An alterative to deepening existing ports is to develop deepwater ports (DWPs) offshore. There have been two serious applicants for offshore deepwater port licenses. It now appears that the two, LOOP, 18 miles off the coast of Louisiana, and SEADOCK, some 26 miles off the coast of Texas are likely to be developed in the immediate future. In addition to these two consideration is being given to a deepwater port off the east and west coasts. The spill rates expected for the overall operation of LOOP

are of the order of some 0.0027 spills greater than 50,000 gallons per million tons of throughput volume. This is about one-tenth the existing nominal rate. Since additional deepwater ports will be similar to LOOP, comparable spill rates can be expected at these facilities.

LIGHTERING. A further alternative to enlarging and deepening U.S. ports is an operational procedure known as "lightering". In this procedure oil is transferred at sea from a very large crude carrier to a smaller tank vessel, which in turn delivers the product to a nearby port. Lightering is common off the West and Gulf coasts.

The process is intuitively less controlled than would be a transfer operation at a deepwater port. It also involves two vessels operating in close proximity to one another. The problem of operation in restricted waters is absent however. Since lightering is typically performed beyond the contiguous zone, no accurate data are available on spill statistics. The spill threat for spills greater than 50,000 gallons from this source is probably greater than the 0.0027 rate for a deepwater port but less than the overall rate of 0.031 for the U.S.

An added difference between the lightering operations and the deepwater port is that the lightering operation results in additional tanker traffic from the operation, whereas the deepwater port utilizes a pipeline. Since the projected level of oil movement through the contiguous states is expected to increase by approximately 60% over the next few years, it is anticipated that more emphasis will be placed on the use of deepwater

ports than lightering operations because of the greater reliability provided by deepwater ports.

1985 SPILL POTENTIALS. The expected 1985 spill potentials for a number of coastal areas of the United States were calculated from the spill rates discussed above and estimates of 1985 throughputs, OCS and deepwater port activities within each area. The ten areas having the highest expected spill potential are listed in Table 4.1.

TABLE 4.1

AREAS OF HIGHEST EXPECTED SPILL POTENTIAL (1985)

Major Port Area	Expected Spills/Yr ≥ 50,000 gal*
Philadelphia, PA	5.07
Valdez, AK**	3.19
New Orleans, LA	2.71
New York Harbor	1.79
Los Angeles, CA	1.19
Richmond, CA	1.15
Pascagoula, MS	1.12
Baton Rouge, LA	1.06
Texas City, TX	1.03
Port Arthur, TX	0.88

The total expected number of spills in major port areas on each Coast and in Alaska, Hawaii and Puerto Rico is indicated in Table 4.2.

* ≥ means greater than or equal to
** Oil transport operations in the Port of Valdez do not typify traditional port operations in the contiguous 48 states. For

**(con't) this reason, it is not expected that the 0.031V per million tons throughput spill rate experienced in the contiguous 48 states will be observed in Valdez. There are presently insufficient statistical data to verify this hypothesis. The average spill rate for the contiguous 48 states has nonetheless been used to predict the 1985 spill rate for Valdez.

TABLE 4.2

COASTWISE SPILL THREAT (1985)

Area	Expected Spills/Yr ≥ 50,000 gal*
East Coast	9.16
Gulf Coast	8.05
West Coast	3.23
Alaskan Coast	3.8
Hawaii	0.19
Puerto Rico	0.09

* ≥ means greater than or equal to

EQUIPMENT SITE SELECTION. In accordance with the goal of the Presidential Initiatives site selections were conceived on the basis of achieving a six-hour response to pollution incidents in U.S. waters. Two general approaches were used to select the sites where response equipment should be located to optimize the potential for achieving this goal.

One approach was to identify all acceptable debarkation ports (ports having equipment to handle heavy response equipment, and sufficient depth of water to allow support vessels to enter) in a region. Sites were then selected so as to encompass the greatest number of possible acceptable debarkation points within six hours transport time of a site. The other approach was to place equipment as close as possible to those areas having the greatest spill potential so as to minimize the response time for as many spills as possible.

EVALUATION CRITERIA. Configurations based on the approaches described above were formulated and improved through an iterative process. The resulting configurations were then critically evaluated against the following criteria:

- o Mean Value of Response Time (time to deliver equipment to the location at which the staging for response is to take place)
- o Fraction of Response Times in excess of 6 hours
- o Fraction of Historic Spills Responded to within 6 hours

The first two criteria were calculated from the projected 1985 spill threat; the third criterion was obtained from the 1974-77 spill history. Of the three, most weight was placed on the mean value response time, since it is believed that this criterion is most closely related to spill recovery effectiveness.

RESULTS. Figure 4.1 is the site configuration which resulted from this analysis. It calls for siting equipment at fourteen locations in the lower forty-eight states, as well as in Alaska, Hawaii, and Puerto Rico. This equipment will be delivered primarily by water or land from all locations. A limited air delivery capability is included to provide for delivery of initial and/or supplemental equipment, particularly to distant spill locations.

This configuration results in a mean value of response time for spills occurring at the probable locations for major pollution incidents of 2.2 hours. Calculations further indicate that the percentage of responses

to these locations that require less than 6 hours should approximate 99.5%. A check of historical data indicates that 90% of past spills greater than 50,000 gallons, and 88.5% of spills between 10,000 and 50,000 gallons occurred within six hours of the proposed equipment site locations. This accounts for 90% of all oil spilled and reinforces the thesis that equipment should be sited around locations thought to have the greatest spill potential. A better indication of the general coverage provided by the proposed configuration is given by the fact that approximately 82% of oil ports within the U.S. having an annual throughput of 1000 tons (308,000 gallons) or more are located within six hours of the proposed sites, while none of the remaining 18% are further than ten hours away.

ALTERNATIVES BASED ON ADDED AIR DELIVERY. The question of further improving response capability and/or reducing the number of sites beyond those indicated in the proposed configuration by adding additional air delivery capability was addressed. The conclusions were that:

o An all air delivery configuration, utilizing existing Coast Guard heavy lift air capability, would fail to meet the six hour response criteria on the average of one in five spills. It would also not provide a sufficient amount of equipment during this time frame.

o The replacement of any significant number of proposed sites within the configuration by an existing Coast Guard heavy-lift air site will also have an adverse affect on the capability of the configuration in the geographical area where the shift is made.

o Adding more airlift capability to the proposed configuration results in very little improvement to the overall capability.



6-HOUR COVERAGE PROVIDED BY RECOMMENDED CONFIGURATION

SUMMARY. The thesis of achieving the six hour response goal by siting equipment in those general areas considered to have a greater potential for major spills, rather than at widely dispersed areas (to provide sparse coverage to many geographic areas) is considered valid.

The selection of a configuration designed to minimize response time to the specific geographical areas that have the highest spill potential rather than to contain the greatest number of possible debarkation ports in six hours, should result in a shorter average response time. This, in turn, should result in greater volumes of oil being recovered. It will be shown in Section 6 that this will also permit the amount of equipment at each site to be reduced, since assistance can be readily provided from geographically adjacent sites when larger spills occur.

The level of success that the proposed configuration will have in achieving the six-hour response goal remains to be tested. Nevertheless, the check against historical data, and the fact that a very large percentage of oil throughput is expected to occur in close proximity to the proposed sites appear to give the configuration a good chance for success. It is therefore recommended that the configuration shown Figure 4.1 be adopted for achieving the six-hour response goal. As indicated in Table 4.3 the proposed configuration will provide direct coverage to major ports areas where the potential in 1985 for spills greater than 50,000 gallons is expected to vary from more than five spills per year to as little as one in 11 years. The configuration is considered to provide as much high-density coverage as is reasonable to expect.

TABLE 4.3

SPILL THREAT ANALYSIS FOR PROPOSED SITING CONFIGURATION

SITE	ANNUAL SPILLS RESPONDED TO*	AVERAGE RESPONSE TIME
EAST COAST		
Boston, MA	1.43	3.5 Hrs.
New York, NY	2.16	2.0
Philadelphia, PA	5.36	1.6
Portsmouth/Norfolk, VA	0.62	2.8
GULF COAST		
Clearwater, FL	1.13	5.0
Pascagoula, MS	1.15	1.8
New Orleans, LA	3.78	1.8
Sabine, TX	1.30	2.2
Galveston, TX	1.02	2.6
Port Aransas, TX	0.76	2.2
WEST COAST		
Los Angeles, CA	1.61	2.1
San Francisco, CA	1.24	1.9
Seattle, WA	0.52**	2.4
GREAT LAKES		
Chicago, IL	0.15	3.3
ALASKA		
Valdez/Anchorage, AK	3.19	1.8
HAWAII		
Barbers Point, HI	0.19	1.6
PUERTO RICO/VI		
San Juan, PR	0.09	1.6

* This indicates the number of spills greater than 50,000 gallons which are expected to occur in the area serviced by the site. It should be noted that lesser sized spills will also occur in these areas and be serviced by the sites. The figures also do not include assistance rendered to adjacent sites.

**This estimate may double in 1985 depending on ultimate disposition of Alaskan crude.

5. MASSIVE SPILL CONSIDERATIONS

GENERAL. This section investigates the potential for a massive spill occurring in U. S. waters and discusses the general locations and probable conditions under which massive discharges might occur. The outflow rates and duration of discharges which would most likely result are also discussed. This information is then utilized to estimate the amount of response equipment that might be needed to deal with a massive spill.

HISTORIC TANKER SPILLS. The U. S. dependency on imported petroleum has increased markedly. This dependency is expected to continue over the next 10 to 15 years despite added emphasis on Outer Continental Shelf (OSC), North Slope development, and the development of alternative sources of energy. Much of the imported oil coming into the U. S. as well as that from Alaska, will be transported by very large crude carriers. The threat of an accidental massive discharge occurring in the U.S. waters will increase as the presence of these vessels becomes more frequent.

A review of past oil pollution incidents throughout the world indicates that four incidents have occurred since 1967 in which 100,000 or more tons of oil (30,800,000 gallons) have been discharged. (Three involved 100,000 tons, and one discharged 220,000 tons). These massive spills were studied in detail. Forty other incidents during which at least 3,000 tons (924,000 gallons) were discharged within 50 miles of a coastline were also analyzed in order to determine the most probable conditions under which massive discharges might occur. Eleven of the incidents studied involved tankers with a dead weight tonnage of greater than 100,000 tons.

Although the amount of data available is too small to allow firm conclusions, it appears that groundings (24%) are most likely to occur within or at the entrance to a major harbor, or within 25 miles of a major harbor. The data also suggest that groundings are more likely to lead to explosions or fires than are strandings. (Strandings are those incidents in which the vessel remains hard aground after striking the bottom). Strandings (43%) are found to be by far the most prevalent incident type. Of these, almost 90% are coastal. Of all collisions (19%), only one occurred in or near a harbor. Fires and/or explosions occurred in slightly less than half of all collisions. Structural and/or mechanical failures appear to account for the remaining 14% of the incidents. In the majority of these last cases the vessels were 10 or more years old.

The larger sized spills in the data base were also studied to determine possible rates of discharge that might be encountered. Outflow data on collisions were not included due to their general non-availability. That outflow data on collisions are not available is testimony to the fact that fires and/or explosions often result from collisions. The analysis indicates that mean discharge rates as large as 200 to 600 tons per hour (61,000 to 184,800 gallons) can be expected from accidents involving the largest of tankers.

Another observation is that in the two strandings in which the vessel eventually broke up because of wave action, it took about 350 hours before the vessels became fully open to the sea. The data also suggest, as does a review of normal transport practices, that the largest possible spills will most likely involve crude oils rather than refined product. Further,

it is considered that the maximum sized crude carriers which will be found in U.S. waters will fall in the 250,000 to 350,000 DWT range.

HISTORIC PLATFORM/PIPELINE SPILLS. Another possible source of a massive oil spill in U.S. waters is as a result of petroleum production activities on the Outer Continental Shelf (OCS). Added interest has been generated in OCS development because of the country's increasing dependency on oil imports. Exploratory drilling has only recently begun in the Baltimore Canyon area. In addition, activity is anticipated in the Georges Bank Trough, in the Gulf of Alaska and in the Beaufort Sea.

Data on oil spills occurring on the OCS have been collected for over twenty years. An analytical review of this information indicates that:

o It is unlikely that a massive spill will be caused by a drilling accident.

o Collision of ships with either drilling rigs or production platforms, and weather induced major accidents are rare and historically have not resulted in massive spills.

o Production platform and pipeline accidents are the sources of most spills and have resulted in the largest volumes of oil spilled.

A detailed analysis of worldwide spills from offshore platforms and associated underwater pipelines was then undertaken in order to ascertain the characteristics that would most likely be observed during massive spills from these sources. As in the case of tankers, data were collected for

discharges greater than 3,000 tons. The review indicates that quantities of oil from 7,468 to 38,961 tons (2.3 to 12 million gallons) were discharged in from 10 to 56 days at average rates of from 5.6 to 140 tons per hour (1,725 to 43,120 gallons). Several platform incidents were accompanied by fires, which burned off a large part of the outflow. It was not possible to calculate outflow rates from pipeline ruptures from existing data.

The general conclusion to be drawn is that OCS platform blowouts, in the absence of fires, can reach outflow levels of 100 to 200 tons per hour (30,800 to 61,600 gallons).

MASSIVE SPILL LOCATIONS. While the probability of any massive spill is small, the likelihood of one occurring in certain locations, relative to others, is considered to be more substantial. An analysis was performed to identify those areas within the U.S. that are considered to be the more likely locations for a massive spill.

TANKER SPILL LOCATIONS. The method employed to locate potential massive spill areas that might result from tanker accidents was to project U.S. coastal tanker traffic to 1985. To accomplish this, several coastal areas covering the major parts of the U.S. coast were selected, and the fraction of traffic through each area in 1985 was estimated. Predictions for the 1985 levels included adjustments to flows for Canadian traffic and for the flow of Alaskan oil. It is also possible that by 1985 Persian Gulf traffic, presently transhipped in the Carribean, will go directly to LOOP

or another Gulf Coast deepwater port or to an Atlantic Coast deepwater port. Adjustments for this possible shift were considered.

The results of the analysis indicate that East Coast receipts of crude will account for 30% of total U.S. crude movement, almost all of which will come from the southeast. Gulf Coast receipts of crude will account for 26% of the total U.S. crude movement, virtually all of which passes through the Straits of Florida. Pacific Coast receipts of crude will amount to 25% from Alaska (north) and 16% from south or southwest.

These projections imply that there will be two coastal areas where crude oil traffic will substantially increase, and, in fact, dominate U.S. coastal crude oil movements. They are the Straits of Florida and the West Coast from Alaska.

Secondarily, heavy crude and product traffic will move up the East Coast from the Caribbean, from the Straits of Florida, and from West African ports, in addition to possible large crude carriers from the Persian Gulf to deepwater ports in the northeast U.S. via the South Atlantic.

OCS SPILL LOCATIONS. During the 1980-1990 time period a massive spill could occur in any one of four OCS regions: the Gulf of Mexico, off the coast of Southern California, over the U.S. Atlantic OCS, or from offshore oil areas off the coast of Alaska. Since only a limited amount of exploratory drilling has occurred off the Atlantic and Alaskan coasts,

it is not possible to predict with certainty the risks which may be associated with platform production in these "frontier" areas. It is believed however, that the harshness of the Alaskan environment may tend to make it a more likely site for a massive discharge. The Atlantic Coast area is considered to be a less likely spot than Alaska, but more likely than the other two areas because of its "novice" status.

SCENARIOS. The information developed above was utilized to construct plausible scenarios for possible massive spills at the locations identified as being most probable. Consideration was given to the typical and worst types of weather that might be encountered, and expected evaporation, spreading, and mixing rates for the oil.

Two scenarios for which detailed responses were developed included:

o The grounding and subsequent stranding during February in the Straits of Juan de Fuca of a Trans-Alaskan Pipeline 165,000 DWT tanker, carrying 154,000 tons of Prudhoe Bay Crude, with the subsequent loss of all cargo.

o A collision during July in the Straits of Florida of a 356,000 DWT tanker, carrying 335,000 tons of Arabian crude on voyage from the Gulf of Persia to LOOP, with a 15,000 DWT tanker carrying 12,000 tons of residual oil. As a result of the collision 96,000 tons of oil are released into the sea. The response is complicated by a fire resulting from the collision.

CONCLUSIONS. The study of these scenarios indicates that a capability to offload approximately 100,000 tons of crude oil in a pumping period of

48 hours using emergency offloading equipment is needed to meet "worst case" threats of massive discharges from groundings and/or strandings of very large crude carriers. It can be shown that 11 sets of the state of the art portable offloading units identified in Section 3 will be required to accomplish this. It would however, require relatively ideal working and weather conditions, rapid access to information on the ship, and the immediate availability of a sufficient number of tank vessels to offload into.

Under conditions, such as those simulated in the scenarios, where bad weather permitted only a short period of time for removal of a very large amount of oil, it would be necessary to consider other alternatives such as jettisoning some of the oil. This would expedite removing the stranded vessel and avoid the possibility of the vessel breaking up and spilling its entire cargo.

Another alternative would be to flood the vessel (ballasting down) so that it could be put firmly on the bottom to better withstand the forces being placed on it by the severe weather conditions. The condition of the vessel would have to be known to determine whether such an action would be safe. The ballasted vessel would then be refloated at a later time when the weather conditions would permit the vessel to be safely offloaded.

The general conclusion to be drawn is that it is technically feasible to satisfy the "worst case" offloading situation developed in the scenario, using state of the art response equipment. It is more likely however, that other alternatives such as jettisoning or ballasting down

will have to be undertaken when weather conditions are such that there is insufficient time to safely offload a distressed vessel before its possible destruction.

The need for accomplishing improvements in state of the art offloading equipment, vessel damage assessment and salvage techniques, and for insuring that offloading vessels are available is addressed in Section 3.

Another area to be addressed is the amount of skimming capability needed to cope with a massive spill. Calculations based on the first two scenarios indicate that as many as fifty-four of the state of the art recovery units identified in Section 3 might be needed to keep up with the maximum rate at which recoverable product might be released.

The scenario which suggested the need for fifty-four units amounted to a "worst case" situation in which 100,000 tons of oil were discharged instantaneously and recovery was to be accomplished in approximately three days. The probability for such an event occurring is considered too remote to be used as a planning factor. History implies that discharges will occur over a finite period of time, with rates around 200 tons per hour being most likely (although a mean rate of approximately 600 tons per hour has been observed once). The rate of 200 tons per hour equates to approximately 25 state of the art oil recovery units. As was the case for offloading, it is technically feasible to meet the recovery requirement. The problem of having an adequate number of proper tow vessels and tank vessels

to discharge into will most likely limit the rate at which oil can be recovered. Proposals for minimizing these limitations were outlined in Section 3.

The scenarios addressed thus far are considered to be representative of feasible worst case situations that could occur in temperate climates. Several other scenarios were developed to determine what could be done in response to spills occurring in arctic regions. The "worst case" arctic scenario studied was a well blowout during February of a very large reservoir in the Chukchi Sea caused from a ground fault within 100 feet of the drill rig. The oil release rate of 7,000 tons per day is accompanied by a continuous release of gas. The blowout is arrested with the completion of a relief well after 45 days, but not before some 300,000 tons of oil are discharged.

The result of modeling this and other possible scenarios indicate that the response to a massive discharge in arctic regions of Alaska presents the most difficult set of conditions to deal with. These same conditions, however, will tend to confine the spilled oil by natural containment, retard evaporation, and expand the time frames over which response actions can be taken. At the same time, recovery actions will be made more difficult, if not impossible. The problem of Arctic response is addressed in the recommended research and development program.

The need for carrying out a research and development effort to insure that the kinds of equipment needed to support arctic response are developed in time to meet the spill threat that will accompany development of OCS oil in arctic regions is addressed in Section 3.

SUMMARY. Although only a limited number of discharges of oil of 100,000 tons or greater have occurred throughout the world, the threat of an incident occurring within the vicinity of the U.S. is real and will increase as more oil is moved by larger sized tankers.

The largest spills will most likely occur as a result of tanker accidents and involve crude oil. The mean outflow rates to be expected will be from 200 to 600 tons per hour. If conditions are such that the discharging vessel will break up, the break up should occur over an extended period of time (approximately 350 hours) with oil being discharged periodically during the incident.

Finite amounts of state of the art pollution response equipment can technically cope with the pumping and recovery requirements that can be expected from massive discharges. The use of this equipment will however, be restricted during periods of adverse weather (see Section 3). It may also be limited because of a lack of availability of support vessels, or a lack of information about the discharging vessel. Actions that can be taken to alleviate or minimize a number of these limitations are recommended in Section 3.

Since tanker accidents often occur during periods of bad weather, it is unrealistic to expect that it will always be possible to offload or recover

oil discharged during tanker accidents. Because of this it will be necessary to consider taking alternative actions, such as jettisoning or ballasting dow , when expected weather conditions preclude offloading the vessel.

It must be recognized that because of evaporation and natural mixing, even under optimum conditions, it is unlikely that recovery rates of greater than 50% can be achieved for massive discharges involving crude oil. Further, due to the unusual extreme of conditions in the arctic it will be unlikely that over 25% of any oil spilled in massive discharges in the arctic will be recovered.

6. REQUIRED EQUIPMENT AND PERSONNEL SUPPORT LEVELS

GENERAL. The information developed thus far indicates that, within certain limitations, equipment and techniques exist for coping with actual and potential pollution incidents. It also indicates that a capability to respond to a large number of expected pollution incidents within six hours of notification can be established by siting equipment at a limited number of locations within the U.S., and Puerto Rico.

Further, the information in Section 5 shows that a certain inventory of equipment is needed in order to respond effectively to a pollution incident of massive proportions. The amount of equipment that should be maintained at each site, within each geographical region and in the nation as a whole, is discussed below. The level of support personnel required to insure a rapid response and to maintain the equipment is also addressed.

APPROACH. Several methods were investigated to determine the relative amounts of equipment which should be maintained at the various locations in the preferred site configuration. The approach used was to consider first the "non-massive" spill part of this problem, and then to make any necessary adjustments to provide for an adequate response to a massive discharge.

NON-MASSIVE SPILL CONSIDERATIONS. A review of the national spill data from 1974-77 indicates that 95% of all discharges have been less than approximately one million gallons (3,248 tons) in size. Spills greater than or equal to this size have occurred in the coastal waters of the U.S.

with an average frequency of approximately one per year over the past ten years. Additionally, discharges of greater than five million gallons (16,234 tons) have only occurred twice during this time. Because of the relatively high frequency of large volume spills it was decided that each general geographic region of high spill potential should have ready access to the equipment necessary to cope with an actual or potential discharge of up to one million gallons. Further, the response effort should be able to be completed within the average period of approximately three days, the time between winter storms when weather conditions are not expected to exceed the limitations of response equipment.

Equipment levels were then determined for each location in the preferred site configuration. Consideration was given to the spill potential within the specific region serviced by each location and the amount of equipment commercially available. The following criteria were also used in determining specific equipment needs. Six state of the art recovery units can be expected to recover one million gallons of oil in three days. One emergency offloading unit will provide sufficient pumping capability to meet routine requirements (one unit can offload one million gallons in a day).

The need to deliver response equipment by land, water and air and to provide a limited amount of portable storage capacity was also considered. In addition, a limited harbor skimming capability is required in those areas where harbor skimming devices are not available through the commercial sector and open water skimming units are not expected to fulfill requirements. Finally, region specific needs, such as the existence of winter

ice conditions or areas of fast current, were addressed. The resulting levels of equipment are indicated in Table 6.1.

TABLE 6.1

PROPOSED EQUIPMENT LEVELS FOR RECOMMENDED SITE CONFIGURATION

	EQUIPMENT LEVELS		
EAST COAST	RECOVERY UNITS*	OFFLOADING UNITS	OTHER CAPABILITIES (see notes.)
Boston, MA	4	1	c, d
New York, NY	3	1	b, d
Philadelphia, PA	6	2	b, d, e
Portsmouth/Norfolk, VA	2	1	b
Alexandria Bay	0	0	b
GULF COAST			
Clearwater, FL	3	1	a, d(2)
Pascagoula, MS	2	1	c
New Orleans, LA	4	1	b, d
Sabine, TX	2	1	c
Galveston, TX	4	1	b, d
Port Aransas, TX	2	1	b
WEST COAST			
Los Angeles, CA	3	1	d
San Francisco, CA	4	1	a, b, d
Seattle, WA	3	1	b, d
Portland, OR	0	0	b
GREAT LAKES			
Chicago, IL	1	1	e

	RECOVERY UNITS*	OFFLOADING UNITS*	OTHER CAPABILITIES
ALASKA			
Anchorage	0	0	b
Kodiak	2	1	a, e
HAWAII			
Barbers Point, HI	1	1	a, c
PUERTO RICO			
San Juan, PR	1	1	c
TOTAL	47	18	

Notes.

a = Coast Guard air delivery capability in area

b = Fast current unit site

c = Harbor skimmer site

d = 255,000 gallon portable storage bag available

e = Special equipment to deal with ice response

* = Current inventories of response equipment include sixteen open water barriers (of which six are now being converted to skimming barriers). Provided expected FY79 funding materializes the remaining ten will be converted and ten new skimming barriers will be purchased. Eighteen emergency offloading systems are also included in the current inventory.

MASSIVE SPILL CONSIDERATIONS. The following assumptions were made in determining the amount of equipment shown in Table 6.1 that would be available to respond to a massive spill: (a) Ten percent of the inventory will be in overhaul or a state of disrepair; (b) Equipment outside of the lower forty-eight states is not readily available for use; (c) It is desirable

to maintain one oil recovery unit in each region to address routine discharges occurring during the time of the massive spill. Based on these assumptions, 13 emergency offloading units, and 26 oil recovery units would be available for use during a massive discharge.

As indicated in Section 5, there is a worst case need for 11 offloading units and a sufficient number of oil recovery units to keep up with an outflow rate of approximately 200 tons per hour that would be expected from a massive spill. The 13 offloading units available in the configuration meet the offloading requirements. The 26 recovery units available represent a collective recovery rate of approximately 220 tons per hour and therefore meet the potential need for recovery units. It can be concluded that the inventory of equipment required to address the non-massive spill threat provides sufficient amounts of equipment to address the massive spill requirements, provided the equipment can be collected and delivered in the necessary time frame.

TRANSPORTATION CONSIDERATIONS. The period of time over which the various amounts of equipment would be required to be delivered to the scene of a massive spill were determined for the various massive spill scenarios outlined in Section 5.

The analysis underlined the importance of promptly initiating response actions. It further indicated that the vast majority of transport requirements for massive spills occurring on the East and Gulf coasts can be met by transporting the needed equipment over land. The analysis further indicated that the delivery times required for possible West Coast massive

spills could also be made from the proposed site configuration, but only if a rapid and significant level of air support were provided by the U.S. Air Force. Since it is very likely that arrangements can be made with the Air Force for such support, it is concluded that the massive spill threat can be met reasonably by the levels of equipment necessary to meet the non-massive spill threat.

SUMMARY. The levels of equipment specified in Table 6.1 for each of the recommended equipment sites will collectively provide for a rapid response to discharges of oil occurring in the coastal regions, ports and harbors, and Great Lakes. The levels will allow each geographical region to undertake recovery of a discharge of up to one million gallons in a period of 72 hours. This will permit each region to respond in a timely manner to the largest size discharges that can be expected to occur with any reasonable degree of frequency.

The configuration will collectively provide a means for responding effectively to discharges of massive proportions, provided adequate air support is made available by the U.S. Air Force for incidents occurring on the West Coast.

It is therefore recommended that the equipment specified in Table 6.1 be considered for procurement and staging at the locations indicated.

FINANCIAL AND SUPPORT CONSIDERATIONS. The capital investment of $32.8M required to procure response equipment is but one of the expenses that must be incurred in order to achieve the six hour response and 100,000 ton

goal. Of paramount importance is the need for 333 new personnel to provide for a minimum twenty-four hour watch to permit equipment to be readied and/or transported to the scene of a pollution incident upon notification of need. The personnel also provide a limited response force for deploying and operating response equipment. It is interesting to note that regional forces, or Emergency Port Task Forces, are already called for in the Federal Water Pollution Control Act of 1972, as amended. These forces will be supplemented by the existing National Strike Force when pollution incidents occur which are beyond an EPTF's capabilities. The need for making rapid damage assessments of distressed vessels was addressed in section 3. The National Strike Force is considered to be the logical group to provide this service. Twenty-five new personnel should be added to the Strike Force for this purpose. It must be recognized that response personnel are needed at each area if the rapid response goal is to be met. A summary of the various acquisition and support costs required to implement the response system is included in Table 6.2.

TABLE 6.2

SUMMARY OF ACQUISITION AND SUPPORT COSTS ASSOCIATED WITH RECOMMENDED RESPONSE SYSTEM

ITEM	COST ($,000s)	
	Non-recurring	Recurring
Equipment for Emergency Port Task Force (EPTF) (includes 11 AC&I positions for 3 yrs)	33,600	1,900
Provide personnel for Emergency Port Task Forces (333 personnel)	536	4,100
Site Construction and Land Acquisition to house EPTF and Equipment, and relocate strike teams to high spill potential areas. (includes 14 AC&I positions for 3 yrs)	13,600	2,300
GENERAL SUPPORT		
1. Provide for proper training (includes 6 personnel)	400	440
2. Provide diving capability and salvage expertise to make rapid vessel damage assessment possible. (25 personnel)	50	360
3. General administration (27 personnel)	66	600
TOTALS	48,242	9,700

It is recommended that the proposed response structure and acquisitions be accomplished over a three-year period. This will permit sufficient time to perform the necessary land acquisition, construction, and training of personnel.

Dollar levels expressed in this document are approximate 1978 dollars. Individual items may require adjustment pending the completion of detailed acquisition planning.

7. CONCLUSIONS AND RECOMMENDATIONS

The major conclusions and recommendations of the study effort to determine the feasibility of implementing the Presidential Initiatives concerning pollution and response stated in the Presidential Message of 17 March 1977 on the prevention of oil pollution of the seas are summarized in this section.

CONCLUSIONS

Feasibility of Improving the State of the Art of Pollution Response Techniques and Equipment.

a. The rapid offloading of a distressed vessel can be impeded by: lack of ship's plans and stability information, and/or insufficient data concerning the vessel's condition; time delays in accessing heavy salvage gear or vessels to offload into; or because of limitations in the offloading equipment itself (capacity and ability to pump very viscous fluids).

b. Improvements can be achieved in all of the above cited areas except one. It is considered unlikely that a significant improvement can be made in the rate with which emergency offloading pumps remove cargo.

c. Existing oil recovery units can be expected to function in five foot seas and currents at speeds of advance of less than 1-1/2 knots.

d. It appears that the existing limitations on state of the art pollution response equipment can be extended so that oil recovery operations can be carried out in wind-driven seas of up to seven feet in the near future, and eventually in wind-driven seas of up to ten feet.

e. Preliminary investigations also indicate that most oils will be fully dispersed into the water column when sea states are in excess of ten to twelve feet in height.

f. It appears technically feasible to develop a dedicated open water skimming vessel which could recover oil in the highest sea state in which a slick might exist. Such a vessel could incorporate many of the subsystems required to support a response operation. The projected costs for such a device are very high in comparison to alternative approaches. The capital investment is not expected to result in a system capable of recovering greater amounts of oil or capable of serving as large a geographical area as can be projected for other less costly alternatives.

g. The two most promising candidates for open water recovery are the skimming barrier and vessel of opportunity skimming system (VOSS). Both need to be supported by vessels having very low speed towing and maneuvering capability. There are relatively few of such vessels available throughout the U. S.

h. The greatest potential for winter pollution incidents can be shown to exist in the northeast sector of the U. S. An average duration of weather favorable to recovery of slightly less than 3 days can be expected, with 34% of the periods of favorable weather exceeding that time in this area. A "weather window" of this size is considered to offer a good potential for carrying out recovery operations.

i. Although it appears that dispersants can be applied in any weather conditions in which a slick would exist, there is considerable controversy about their effect on the environment. There is both a limited supply and limited capability to spray dispersants within the U. S.

j. The influence of ice in varying forms on an oil recovery operation is complex. In general its presence will tend to confine the spilled oil by natural containment, retard evaporation, and expand the time frames over which response actions can be taken. It may also make response actions difficult or impossible.

k. A Coast Guard sponsored research and development effort nearing completion has the potential for producing a skimmer which will recover oil in up to eight knots of current in harbor conditions (in seas up to a two-foot chop).

l. It will be necessary on certain occasions to consider offloading (jettisoning) a small percentage of the cargo from a distressed vessel directly into the sea when there is a need to free the vessel in order to avert it breaking up and discharging its entire cargo. This will occur when the vessel's condition is considered to be such that there is a strong chance that it will break up before offloading could be initiated or completed.

m. Another salvage technique that will be used from time to time will be to intentionally flood a distressed vessel to put it firmly on the bottom so that it can better withstand the forces being placed on it by waves and the current. The vessel would then be raised at a later date when the weather could be expected to permit offloading to be accomplished successfully.

n. Regardless of advances made in the state of the art, there will be occasions when weather conditions, considerations for the safety of response personnel, and other factors will prohibit effective response efforts from being carried out.

NON-MASSIVE SPILL THREAT

a. From an examination of spill data from the various available

sources for the years 1974-77 it was estimated that the average number of spills over 50,000 gallons in all U.S. coastal waters is 0.031V/MT, where V is the petroleum throughput in millions of tons.

b. Based on existing throughput levels approximately 22 spills greater than 50,000 gallons can be expected to occur in the U.S. this year (1978). Approximately 80% of the total volume of oil spilled will result from these few spill incidents.

c. Spills from transient tankers and barges, and from deepwater ports are much less likely to occur than are discharges from conventional oil port operations and Outer Continental Shelf production. Insufficient data are available to estimate accurately the spill threat associated with lightering operations.

d. At the historic 0.031V/MT spill rate the U.S. can expect about 38 coastal spills over 50,000 gallons in 1985, assuming no changes in oil transport technology. If about 440 million tons per year are received and transported through deepwater ports, the expected spills in 1985 are estimated at 26, only slightly more than the number projected for 1978.

EQUIPMENT SITING/SIX HOUR RESPONSE.

a. Siting emergency offloading and oil recovery equipment at various locations throughout the United States can provide for a quick and effective response to the vast majority of pollution incidents; and will also result in the elimination of a threat of a discharge on a number of occasions. But it is unrealistic to expect that such actions will result in an effective offloading and/or oil recovery operation being possible during every pollution incident.

b. Analysis of spill threats for various geographical regions indicates that major threat areas generally are confined to specific geographical corridors, rather than being dispersed widely throughout the country. It is possible to formulate a siting configuration that meets the six hour response goal by placing equipment within these corridors rather than at widely dispersed sites.

c. It is not possible to formulate an all air delivery configuration to meet the six hour response criteria utilizing only the existing Coast Guard heavy lift capability.

MASSIVE SPILL THREAT

a. Causes of past large and massive tanker spills within 50 nautical miles of shore were groundings (24%), strandings (43%), collisions (19%), and mechanical and structural failures (14%).

b. Average outflow rates of the order of 200 to 600 tons per hour have been characteristic of the largest tanker spills. Discharge quantities from 100,000 to 220,000 tons have been observed.

c. Data on OCS related accidents show that the discharge rates ranged from 6 to over 100 tons per hour, with total volumes ranging from 7,000 to 40,000 tons.

d. Based on assumptions on oil imports, Alaskan oil productions and distribution, possible deepwater ports, and future oil demand, the Pacific Northwest Coast and Straits of Florida appear to have a higher potential for massive spills from tanker operations than other parts of the country.

e. There is a greater probability that a massive discharge will involve a crude oil, rather than refined oil.

EQUIPMENT LEVELS AND TRANSPORT

a. The frequency with which spills of a few million gallons of oil occur (approximately once per year) implies that a capability should exist within each general geographical region to quickly handle a response of this magnitude.

b. The historical frequency of spills 5 million gallons and greater is approximately one every five years. Spills of this magnitude should therefore be handled on a national rather than regional basis.

c. The amount of emergency offloading equipment required to establish the level of capability specified above for each geographical region will provide the capability needed to meet the offloading requirements of a massive discharge.

d. The number of oil recovery units needed in each regional geographical area to establish the level of capability indicated above will also provide the capability to cope with the mean discharge rates that can be expected during a massive spill.

e. Provided equipment is sited along the geographic corridors of high spill potential the vast majority of transport requirements for equipment needed to cope with massive spills occurring on the East and Gulf Coasts can be met by land transport.

f. Massive spills occurring on the west coast of the United States would require quick and significant support from the U. S. Air Force if an adequate response is to be launched in a timely manner. The only apparent alternative to avoid this dependence would be to place large amounts of equipment in stockpiles at various additional locations along

the west coast. Such actions would be costly and would not guarantee that the stockpiles would be close enough to the spill site to obviate the need for considerable air support.

RECOMMENDATIONS

a. The Coast Guard should carry out an active program of research and development, engineering application, and operational testing to advance the state of the art in pollution response in those areas where it has been concluded that advancement is possible and warranted.

b. The Coast Guard should seek to negotiate an international agreement through the Intergovernmental Maritime Consultative Organization to require tanker owners to file information such as ship's plans and stability data. These data, which may be needed in emergencies should be available at specified locations so that it can be quickly accessed when needed.

c. The Coast Guard should modify its vessels and aircraft and develop future requirements, as well as execute standby contracts as necessary, in order to alleviate problems associated with the availability of pollution response support vessels and aircraft.

d. The highest priority should be given to developing those items dealing with improvements in offloading and salvage capabilities, as successes in these areas will reduce the volume of oil entering the oceans.

e. Oil pollution response equipment should be sited at fourteen locations in the lower forty-eight states (Boston, MA; New York, NY; Philadelphia, PA; Portsmouth, VA; Clearwater, FL; Pascagoula, MS; New Orleans, LA; Sabine, TX; Galveston, TX; and Port Aransas, TX; Los Angeles, CA; San Francisco, CA; Seattle, WA and Chicago, IL, as well as Alaska, Hawaii, and Puerto Rico. This will result in a pollution

response network having a mean value response time of 2.2 hours to discharges occurring at the most probable locations for major oil pollution incidents, with 99.5% of the response efforts to spills at these locations being accomplished in less than six hours.

f. Sufficient equipment should be placed in each geographical spill region to permit a response to be mounted to recover up to one million gallons of oil at any one site in the region within 72 hours after recovery operations are undertaken (weather, and safety considerations not withstanding). Equipment and personnel levels to achieve this are provided in the report.

Oil Pollution of the Oceans

The President's Message to the Congress Recommending Measures To Control the Problem. Dated March 17, 1977. Released March 18, 1977

To the Congress of the United States:

The recent series of oil tanker accidents in and near American waters is a grave reminder of the risks associated with marine transportation of oil. Though we can never entirely eliminate these risks, we can reduce them. Today I am announcing a diverse but interrelated group of measures designed to do so.

These measures are both international and domestic. Pollution of the oceans by oil is a global problem requiring global solutions. I intend to communicate directly with the leaders of a number of major maritime nations to solicit their support for international action. Oil pollution is also a serious domestic problem requiring prompt and effective action by the federal government to reduce the danger to American lives, the American economy, and American beaches and shorelines, and the steps I am taking will do this.

The following measures are designed to achieve three objectives: First, to reduce oil pollution caused by tanker accidents and by routine operational discharges from all vessels; Second, to improve our ability to deal swiftly and effectively with oil spills when they do occur; and Third, to provide full and dependable compensation to victims of oil pollution damage.

These are the measures I recommend:

• RATIFICATION of the International Convention for the Prevention of Pollution from Ships. I am transmitting this far-reaching and comprehensive treaty to the Senate for its advice and consent. This Convention, by imposing segregated ballast requirements for new large oil tankers and placing stringent controls on all oil discharges from ships, represents an important multilateral step toward reducing the risk of marine oil pollution. In the near future, I will submit implementing legislation to the Congress.

• REFORM of ship construction and equipment standards. I am instructing the Secretary of Transportation to develop new rules for oil tanker standards within 60 days. These regulations will apply to all oil tankers over 20,000 deadweight tons, U.S. and foreign, which call at American ports. These regulations will include:

—Double bottoms on all new tankers;

—Segregated ballast on all tankers;

—Inert gas systems on all tankers;

—Backup radar systems, including collision avoidance equipment, on all tankers; and

—Improved emergency steering standards for all tankers.

These requirements will be fully effective within five years. Where technological improvements and alternatives can be shown to achieve the same degree of protection against pollution, the rules will allow their use.

Experience has shown that ship construction and equipment standards are effective only if backed by a strong enforcement program. Because the quality of inspections by some nations falls short of U.S. practice, I have instructed the Department of State and the Coast Guard to begin diplomatic efforts to improve the present international system of inspection and certification. In addition, I recommend the immediate scheduling of a special international conference for late 1977 to consider these construction and inspection measures.

• IMPROVEMENT of crew standards and training. I am instructing the Secretary of Transportation to take immediate steps to raise the licensing and qualification standards for American crews.

The international requirements for crew qualifications, which are far from strict, will be dealt with by a major international conference we will participate in next year. I am instructing the Secretary of Transportation to identify additional requirements which should be discussed, and if not included, may be imposed by the United States after 1978 on the crews of all ships calling at American ports.

• DEVELOPMENT of Tanker Boarding Program and U.S. Marine Safety Information System. Starting immediately, the Coast Guard will board and examine each foreign flag tanker calling at American ports at least once a year and more often if necessary. This examination will insure that the ship meets all safety and environmental protection regulations. Those ships which fail to do so may be denied access to U.S. ports or, in some cases, denied the right to leave until the deficiencies have been corrected. The information gathered by this boarding program will permit the Coast Guard to identify individual tankers having histories of poor maintenance, accidents, and pollution violations. We will also require that the names of tanker owners, major stockholders, and changes in vessel names be disclosed and included in this Marine Safety Information System.

• APPROVAL of Comprehensive Oil Pollution Liability and Compensation Legislation. I am transmitting appropriate legislation to establish a single, national standard of strict liability for oil spills. This legislation is designed to replace the present fragmented, overlapping systems of federal and state liability laws and compensation funds. It will also create a $200 million fund to clean up oil spills and compensate victims for oil pollution damages.

• IMPROVEMENT of federal ability to respond to oil pollution emergencies. I have directed the appropriate federal agencies, particularly the Coast Guard and 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 six hours to a spill of 100,000 tons.

Oil pollution of the oceans is a serious problem that calls for concentrated, energetic, and prompt attention. I believe these measures constitute an effective program to control it. My Administration pledges its best efforts, in cooperation with the international community, the Congress, and the public, to preserve the earth's oceans and their resources.

JIMMY CARTER

The White House,
March 17, 1977.

REFERENCES

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