

INTERNATIONAL

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1993 Oil Spill Conference

Prevention,
Preparedness,
Response

PROCEEDINGS



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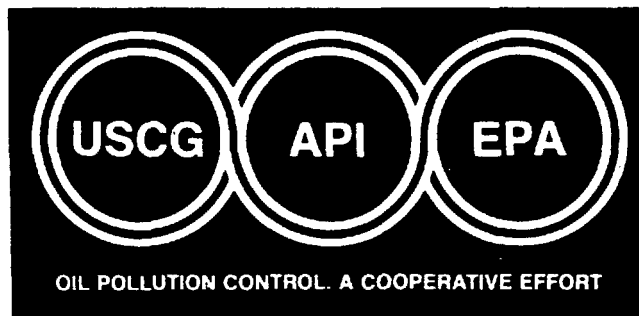
1993 International Oil Spill Conference

Proceedings

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In Memoriam

U.S. Coast Guard Commander Mark L. Lavache 1947–1992

The 1993 International Oil Spill Conference Proceedings volume is dedicated to the memory of retired U.S. Coast Guard Commander Mark L. Lavache in recognition of his dedicated service and valuable contributions to the Biennial International Oil Spill Conferences.

Among key roles on behalf of the International Oil Spill Conference, Commander Lavache made outstanding contributions in chairing the Conference program committee for three consecutive conferences: 1985, 1987 and 1989.

As program committee chairman, Commander Lavache served with consistent excellence for those six years, longer than any other Conference program committee chairman. In addition, he advised and served "behind the scenes" during the 1991 conference.

Commander Lavache also shared with us his inspiration, courage, strength and grace during times of personal hardship.

1993 International Oil Spill Conference

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FOREWORD

I would like to welcome everyone to the 13th biennial International Oil Spill Conference, jointly sponsored by the American Petroleum Institute, the U.S. Coast Guard, and the U.S. Environmental Protection Agency. The Conference provides an international forum for the exchange of information, the transfer of technology, and the sharing of experiences related to oil spill prevention, preparedness, and response. Participation at this year's Conference is expected to be greater than at all previous conferences—a reflection, I believe, of the world's growing awareness of the need for responsible and effective oil spill control measures.

The Conference has been expanded to a full four-day program incorporating three international panel discussions, more than 125 technical papers, and numerous poster presentations. The committee hereby extends its apologies to many other potential presenters whose papers could not be accommodated in the time available due, only, to the sheer volume of material received. In addition, more than 225 international companies and agencies will exhibit their products and services related to spill prevention and response.

This year's Conference will be truly international in scope, with the underlying theme of international cooperation as it relates to oil spill issues. The International Maritime Organization (IMO) convention on Oil Pollution Preparedness, Response and Cooperation (OPRC) and the Oil Pollution Act of 1990 (OPA 90) will serve as focal points for discussion.

Discussions will include all aspects of spill prevention and preparedness, including planning, training, and research and development. Response issues, including fate and effects of spilled oil, cleanup, bioremediation, and in-situ burning, will also be addressed. Case histories, as well as the legal and economic impacts of oil spills are also on the agenda. In all, I believe that this program will be the most comprehensive to date and will help us all to expand our knowledge and capabilities on this important issue.

The sponsors of this Conference wish to thank the authors of the papers that constitute these proceedings. I also wish to acknowledge the extensive contribution of time and effort by all members of the panels, session chairmen, and planning committees that has gone into making this Conference a successful reality.

Frank J. Durante

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Section I

CONTINGENCY PLANNING

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RESPONSE TO A SPILL OF NATIONAL SIGNIFICANCE¹

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ABSTRACT: *Responding to a spill of national significance (SONS), such as the 1989 Exxon Valdez spill, requires an augmenting organization to support the local response organization. The U.S. Coast Guard has developed a SONS protocol to be better prepared to respond to these infrequent catastrophic spills. A flag-level Coast Guard officer assumes the role of national incident commander (NIC) and federal on-scene coordinator (OSC), and is supported by a national incident task force (NITF). The major role of the NITF is to develop a national response strategy, acquire response resources and allocate them efficiently, and effectively deal with many peripheral national issues. Unified command concepts have been incorporated into the NITF and its primary organizational elements. In addition, frequent training and exercising is essential to keep the SONS protocol's preparedness at an acceptable level.*

On 24 March 1989, the tanker *Exxon Valdez* struck Bligh Reef while departing the port of Valdez, Alaska. As a result, nearly 11 million gallons of oil were discharged into Prince William Sound and surrounding waters, in the nation's worst oil spill. It soon became obvious that the existing response organization at the Coast Guard Marine safety office in Valdez, augmented by the local response community, the State of Alaska's response agencies, the regional response team (RRT), and additional Coast Guard district resources, could not adequately battle a spill of this size. Emerging environmental and political issues exacerbated the situation. Unfortunately, no plan preexisted to accommodate the response prosecution and support of a spill of this magnitude—a spill of national significance (SONS). One of the most pressing issues became the need for a crisis management organization of sufficient size and stature to implement a credible response effort quickly and effectively.

An ad hoc organization was created, through trial and error, by the federal on-scene coordinator (OSC). The organization that eventually evolved proved functional and forms the basis for the national incident

task force (NITF). Hindsight points out two organizational deficits in the *Exxon Valdez* response.

- When the decision was made to create a "super" response organization, there was no preexisting plan to implement it. The specifics of the organization were unknown, just that something was needed and it had to be big. There was no organization scheme, no implementing procedures, and no standard operating procedure.
- It took several months to develop and implement a coherent national strategy to deal effectively with the issues and to prioritize the scarce resources in concert with that national strategy.

An outgrowth of the public concern that grew during the *Exxon Valdez* response is the expectation that the United States will be better prepared when the next such spill occurs. Congress mandated, through the Oil Pollution Act of 1990, that industry and government be better prepared. The SONS protocol serves to satisfy this national expectation.

Spills of national significance

A spill of national significance (SONS) is defined as "one which greatly exceeds the resource capability within the district/region to deal with the incident; a spill which, due to its size, location, actual or potential impact on the environment, and/or the complexity of the response, requires extraordinary coordination of federal, state, local and responsible party efforts to contain and clean up."

Implicit in the above definition and clearly among the significant factors in classifying a spill as a SONS are:

- A high level of political and media interest,
- Positive control of the event is beyond equipment and personnel available to the federal OSC and surrounding Coast Guard district,
- State governor(s) request(s) designation or concurrently governor(s) request(s) of president to declare a major disaster or emergency as a result of a spill,
- Significant public concern and demand for action by parties associated with the event,
- Protracted period of discharge and/or expected cleanup,
- Significant impact upon or threat to: wildlife, population, econ-

1. Opinions or assertions expressed in this paper are solely those of the authors and do not necessarily represent the views of the U.S. government.

omy, property, public health and welfare over broad geographic area, and

- Multiple OSC zones/districts/international borders affected.

The *Exxon Valdez* is clearly a benchmark for a spill of national significance. The *Mega Borg*, *American Trader*, and *World Prodigy* incidents, while clearly of national interest, probably do not qualify as SONS. The Ixtoc oil well release nearly 15 years ago was probably the last previous spill of this order that the United States had experienced.

SONS protocol

The intent of the protocol is to create a national-level response structure that will be quickly implemented and augment the response capabilities of the predesignated federal OSC. Historically, the OSC has been the predesignated federal official responsible for the direction and coordination of the response. The OSC is responsible for ensuring that these routine functions, common in every spill, are performed. To accomplish this, national, regional, and local area response structures must be flexible, permitting appropriate attention to any or all functions as the situation dictates. The OSC, in most spills, performs both strategic and tactical functions.

While the predesignated OSC is thoroughly familiar with his local area resources and with the response community, he has neither the time nor infrastructure to maintain such familiarity on a national or international scale. The SONS protocol is designed to ensure an orderly transition into the SONS organization by bridging between the OSC's local response capability and the need, during that rare occasion, for national coordination.

During a SONS, the national response system (NRS) remains intact; however, due to the complexity of a SONS response, no single individual can adequately perform the myriad of duties required of an OSC. To meet the demands imposed on an OSC during a SONS, an NITF is implemented to support the OSC in the strategic management of the spill, to acquire resources from national and international sources and allocate them according to the national strategy, and to serve as a buffer between national issues and the OSC tactically managing the cleanup. Key positions in the NITF organization include:

National incident commander (NIC). In charge of the task force is the NIC. For spills occurring in the coastal zone of the United States, the commandant of the Coast Guard may designate a SONS, activate the NITF and designate one of the Coast Guard's vice admirals as the NIC. For spills occurring in the inland zone, the administrator of the EPA has the responsibility to designate a SONS, activate the NITF and designate an NIC. (The remainder of this paper will focus on a SONS in the coastal zone where the Coast Guard has named the NIC.)

The NIC is responsible for directing and coordinating the response at the strategic level and assumes the duties and responsibilities of the federal OSC. He will ensure all possible actions are being taken to clean up the spill, thereby reassuring the public. The predesignated OSC then assumes the designation of area operations coordinator (AOC) and directs the tactical response.

Basic tenets of the NITF are a unified command structure and joint operations. A lesson learned from *Exxon Valdez* was the need for "corporate level" representatives from the state(s), responsible party, and the NIC to reach consensus on a response strategy. Figure 1 illustrates the NITF organization. The unified command organizational elements are depicted as triangles. State and responsible party representatives assigned to the NIC triangle must have absolute deci-

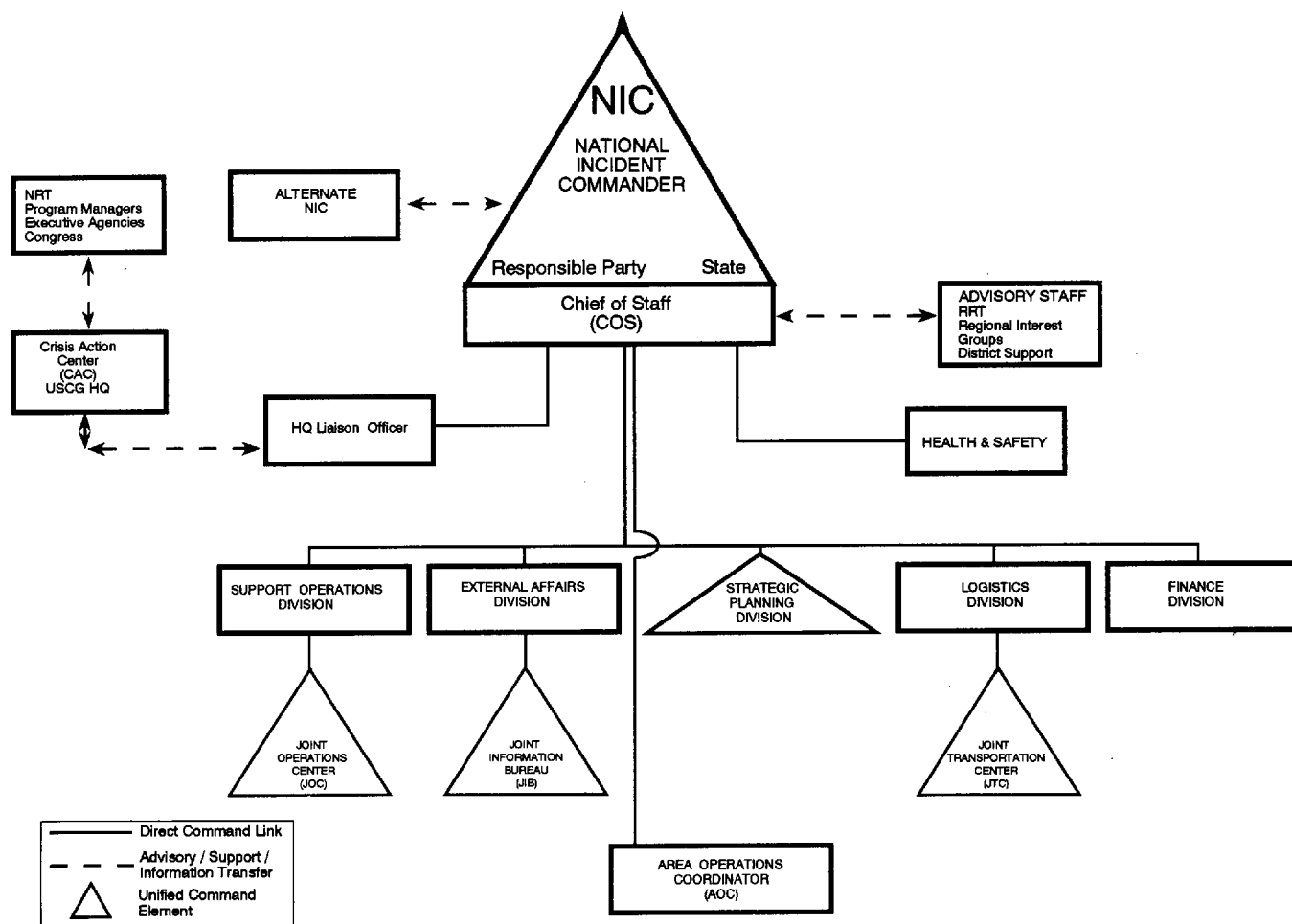


Figure 1. Incident task force organization for spill of national significance

sion-making authority and are envisioned to be the senior state environmental and senior corporate representatives. This team would come together daily, or more often, and promulgate a national response strategy, and resolve such issues as strategic resource use and site cleanup. It is anticipated that consensus will be reached in the majority of issues. However, if occasionally consensus is not reached among the team, then the NIC will assume his statutory role as federal OSC and direct the decision.

Chief of staff. The position of chief of staff will be filled by the commanding officer of the National Strike Force Coordination Center (NSFCC). That person brings cleanup management expertise, current technical familiarity with response techniques, and relationships with other agency/international/academic response communities. The chief of staff is the principal advisor to the NIC on spill response strategy. The chief of staff is the link with the Coast Guard crisis action team (CAT) and liaison with the incident specific chairmen of the national response team and the regional response team, the scientific support community, AOC operations, and external affairs. The chief of staff manages day-to-day activities of the NITF staff.

National incident task force staff. The NITF is also comprised of a number of staff elements to manage and coordinate its responsibilities effectively. Its organization is patterned after the incident command system (ICS) and is very similar to AOC, state, and industry response organizations. This will facilitate rapid implementation during a SONS event and encourage the formation of unified command elements. The major staff components include support operations, strategic planning, logistics, and finance. In addition to these standard ICS elements, an external affairs division has been added to deal with the heavy anticipated public affairs and protocol workload.

As stated before, the NITF organization provides for unified operational and support elements wherever possible. The efficiencies realized from shared resources and personnel as well as the intangible

benefit of commonality of purpose will significantly enhance the spill response. Unified command elements include those that follow.

Joint operations center (JOC). Attached to support operations, the JOC is the command, control and communications center for the NITF's information needs. Staffed by Coast Guard, other federal responders, state, and spiller representatives, the JOC maintains necessary status boards, directs vehicle, vessel, and aircraft movements, and maintains the reference library.

Joint information bureau (JIB). Attached to external affairs, this is the single location for media information dissemination. The JIB coordinates media releases for all response entities, federal, state, and spiller regarding the cleanup. It is critical to present to the public the unified nature of the cleanup and diminish stray stories that are at cross-purpose to the organization's strategic goals. The JIB can also provide regular reports for internal organization and attached agency use.

Joint transportation center (JTC). Attached to logistics, this center acquires and maintains all transportation resources, regardless of mode, attached to the NITF.

Area operations coordinator (AOC). The predesignated federal OSC is the most qualified individual having the requisite local knowledge of the response area and political and industry contacts to initiate and sustain a cleanup operation. To utilize effectively the talents, relationships, and coordination skills developed by the OSC during the area contingency plan development process, all predesignated OSCs within the region or district affected will assume the role of area operations coordinators for tactical response operations, including identification of response priorities, consistent with the national response strategy, and deployment and operation of response resources as allocated by the NIC within their respective zones. Figure 2 illustrates the AOC response organization and lists functions to be included in each organizational element.

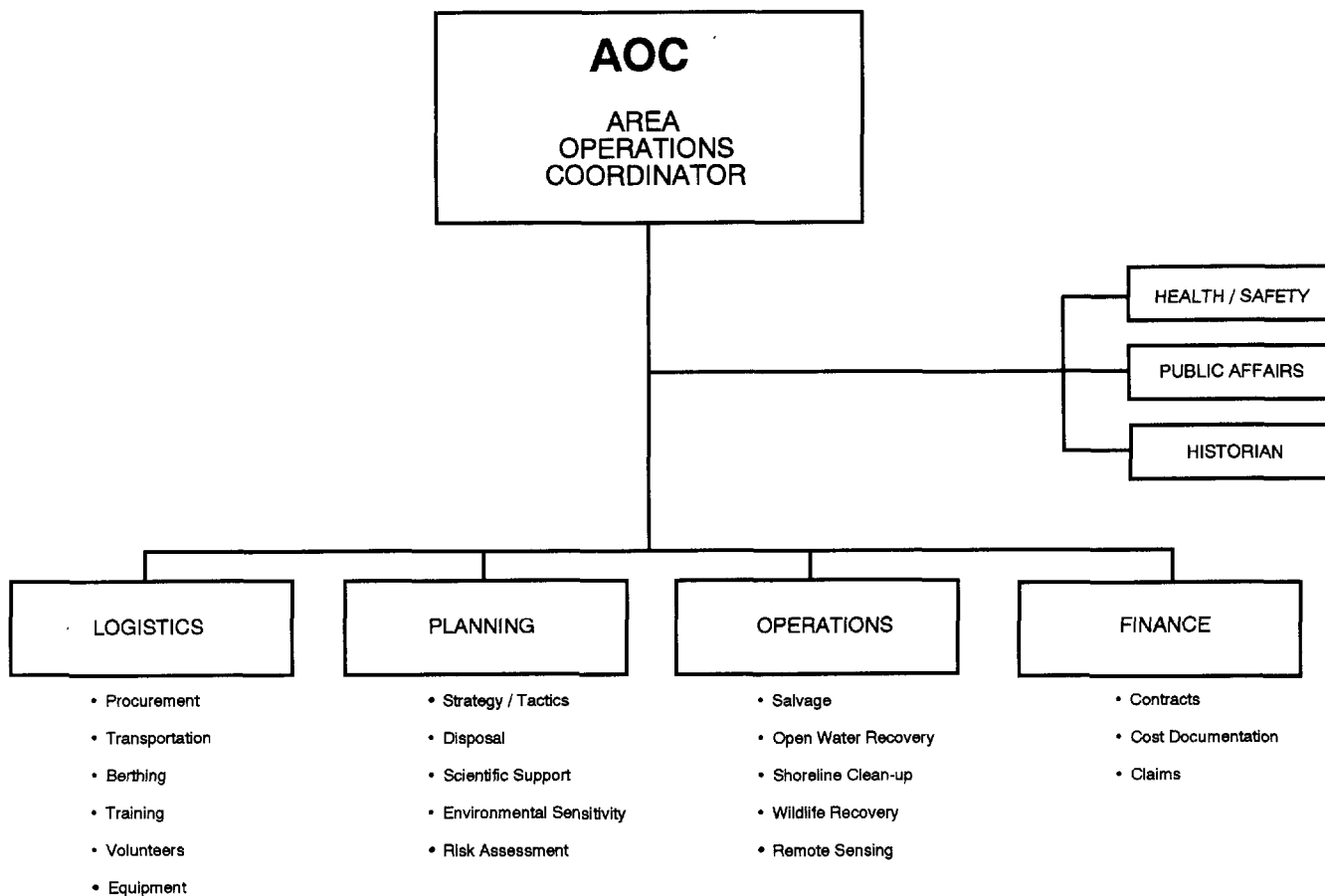


Figure 2. Area operations coordinator's functional organization

Crisis action center (CAC). In the event of a SONS, the CAC should be activated at the request of the head of the Coast Guard's Office of Marine Safety, Security, and Environmental Protection (G-M). The CAC serves as a filter and funnel to the NITF. It should be tasked as a clearinghouse for all support requirements for the NIC. This "one-stop shopping" is viewed as a critical requirement. The CAC should take the NIC support requests and forward them to the appropriate Coast Guard program manager for action. Additionally, requests for information about the spill response, from inside and outside the Coast Guard, should filter through the CAC for forwarding the NITF. The NITF has a billeted position of headquarters liaison that will serve as the focal point for this information exchange. History has shown an enormous need for data from media, Congress, other federal agencies, and Coast Guard program managers. The NITF must provide regular information back to the CAC. The CAC, in turn, should coordinate information requested of the NITF.

NRT/RRT liaison

The roles of the national response team (NRT) and the regional response team (RRT) remain very important. In the SONS organization, the incident-specific chairman of the NRT should assemble the NRT on scene for a short time, to gain first-hand appreciation of the magnitude and impact of the spill, and then return to Washington, D.C., and receive tasking from the CAC for the duration of the response effort. The chief of the Coast Guard's Marine Environmental Protection Division (G-MEP) will assume incident-specific chairmanship and be the principle advisor to G-M. The NRT is an advisory group that addresses national policy issues and supports response operations as opposed to assuming an oversight role.

The RRT should assemble support for the OSC as described in the NCP. During implementation of the NITF, the RRT continues as a tactical support group to the AOC(s). Once the NITF is fully func-

tional, the chief of staff becomes the liaison between the RRT(s), the AOC(s), and the NITF.

Finally, the RRT should not be superseded by the NRT. The functions of both, as outlined in the national contingency plan, are important, distinct and must be respected.

Training and exercises

The greatest danger in any response organization for infrequent disasters is to be unprepared when efficient and effective response is critical. The NITF will require a high level of commitment to qualify members and periodically exercise the organization. With frequent transfers of personnel throughout the federal government, qualification of members assigned to the NITF will be a constant challenge. Pools of subject-matter experts will need to be developed and tracked since one can expect that subsequent assignments will involve the same type of expertise. The NSFCC has been tasked with overall management of the training and qualification program for the SONS organization and with evaluation of the preparedness of the NRS. Evaluation of SONS preparedness will be incorporated into a national exercise program that is under development.

Conclusion

Effectively responding to a spill of national significance requires an innovative, practical organization that can be rapidly implemented as appropriate to develop a national response strategy, acquire necessary resources to carry out that strategy, and proactively deal with the many peripheral national issues. Through the development of a SONS protocol and the predesignation, training and exercising of a national incident task force, the nation will be better prepared to respond to a next *Exxon Valdez* spill.

DEVELOPING STANDARDIZED FACILITY CONTINGENCY PLANS

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ABSTRACT: *Texaco consists of several operating departments that are, in effect, independent companies. Each of these departments is responsible for complying with all environmental laws and regulations. This includes the preparation by each facility to respond to an oil spill at that location. For larger spills, however, management of the response will rest with corporate regional response teams. Personnel from all departments make up the regional teams.*

In 1990, Congress passed the Oil Pollution Act. In 1991, the U.S. Coast Guard began developing oil spill response contingency plan regulations, which they are still working on. Meanwhile, four of the five west coast states have also passed laws requiring contingency plans. (Only Hawaii has chosen to wait and see what the federal regulations will entail.) Three of the states have already adopted regulations. Given these laws and regulations, along with its corporate structure, Texaco addressed the need to standardize local facility plans as well as its response organization.

This paper discusses how, by working together, the Texaco corporate international oil spill response staff and the Texaco western region on-scene commander developed:

- *A standard contingency plan format crossing corporate boundaries and meeting federal and state requirements.*
- *A response organization applicable to any size facility or spill.*
- *A strategy to sell the standard contingency plan and response organization to the operating units.*

Mid-1990 to the end of 1992 found the passing of major oil spill response and prevention legislation at both the federal and state levels. At the federal level, we have the Oil Pollution Act of 1990 (OPA 90). The west coast states of Alaska, Washington, Oregon, and California, not wishing to wait for federal action, passed their own prevention and response laws. Each of these states requires facilities to have a comprehensive oil spill contingency plan. In addition, each requires the completion of such plans before the OPA mandated deadline. (This is as of the writing of this paper. California may require a later submission date.)

Complying with state and federal laws when writing facility contingency plans can be difficult. For example, Washington State requires in WAC 173-181-065(3):

A plan shall be approved if . . . it demonstrates that when implemented, it can: (a) To the maximum extent practicable, provide for prompt and proper response to and cleanup of a variety of spills . . .

Prompt and proper response in Washington, we are told in their Manual for Review of Facility Oil Spill Contingency Plans, is the maximum volume of oil that response equipment can recover in 24 hours multiplied by an efficiency factor of 20 percent. The resulting figure should be at least 5 percent of the worst case spill or 500,000 gallons, whichever is less.² The Coast Guard, meanwhile, is considering using set caps. Not knowing what these caps for facilities will be negates any comparison to Washington's requirements. However, if the federal caps end up being inflexible, requirements could easily be

different between the state and the Coast Guard as to how much equipment must be available. California, meanwhile, is considering caps that will likely be more stringent than the Coast Guard's.

As with most major companies, Texaco's response structure consists of multiple tiers. Tier I is the local, or facility, team, which provides the initial notifications and response when a spill occurs in its area of operation. For most minor spills, the local team will oversee the entire cleanup operation, normally taking no more than a day or two.

Texaco's Tier II consists of six regional response teams: Western, Gulf, and Eastern U.S. teams and Latin America/Western Africa, Europe, and Middle East/Far East teams. For larger spills and special situations, Texaco will activate one of the regional teams to manage response operations.

Each of the domestic teams consists of about 80 Texaco personnel who fill some 35 team positions. Should a spill occur requiring the services of only a few specialists from the regional team, the on-scene commander (OSC) will activate only those specialists. Upon arrival on site, the OSC will place the team member into the appropriate position on the organizational chart. I'll discuss how we handle this later.

Tier III is the Texaco national team, which consists mainly of corporate level personnel who will help manage responses that are beyond the capability of the regional team. Like the regional teams, we can also call upon the national team to help in special circumstances. During a major spill response, personnel from all six regional teams and the national team are available.

The west coast contingency plan project

Spill team organization is a key part to making an effective response. Before OPA 90, Texaco's regional and national teams were horizontally structured, with most positions reporting directly to the respective on-scene commander (Figure 1). As a result, the OSC had difficulty in effectively managing overall spill response operations during incidents or drills. This problem obviously needed correcting. There was also a lack of continuity between facility (local) contingency plans and the regional ones. To remedy this we started our west coast contingency plan project.

Step 1: Reorganizing the team. We first restructured the western region response team by modifying the incident command system (ICS) to fit Texaco's needs. We began with the ICS structure used by British Petroleum during the *American Trader* spill off Huntington Beach, California.¹ After careful analysis, we identified a few additional positions, changed some job titles, and shifted positions around to fit Texaco's business organization better (Figure 2). The result is an organization following the lines of the incident command system, dovetailing with the unified command structure, and easy for Texaco personnel to fit into. We can expand or reduce this organization as needed. This last item was very important since we wanted to take the regional team organization and adapt it to each facility's needs.

To make a response more efficient, we felt there should be little difference in our spill response organization, regardless of facility or

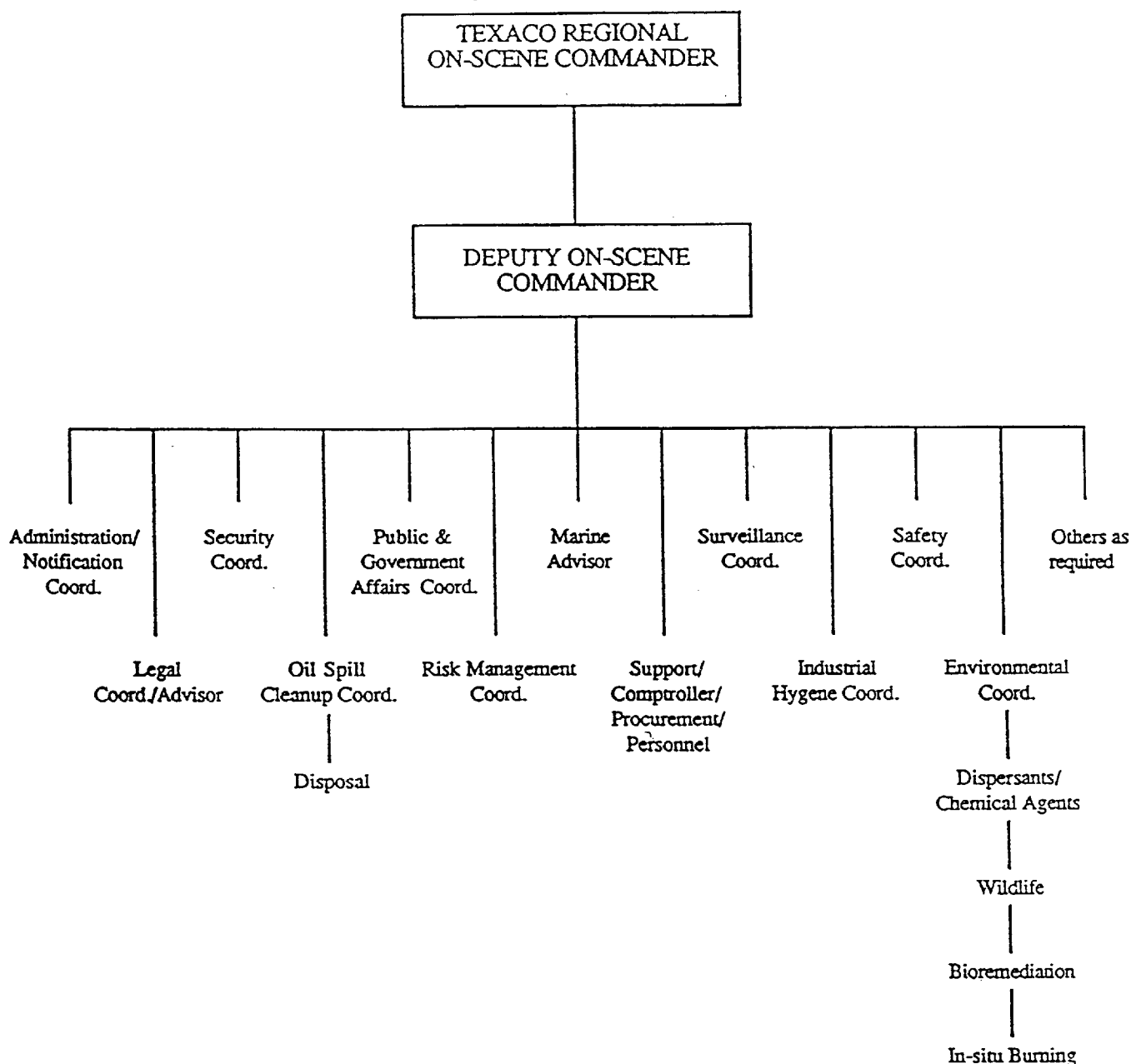


Figure 1. The old Texaco Western Region response team organization

spill size. For example, a small sales terminal may only have five people on their response team. The facility designates one as the OSC. The other four fill the director's positions found on the regional organization chart (Figure 3). Each of these individuals, however, is responsible for all the jobs that fall under that particular director's position. The local team thus covers all the positions identified on the regional team. The facility's contingency plan reflects this in the job descriptions. As a result, this size facility may feel comfortable responding to spills of 25 barrels or less. Anything over that amount, or any spill that creates special problems, results in activating appropriate members of the regional response team. Upon their arrival, these regional team members fit into the facility's response organization by having their specific job function added under the appropriate supervisor.

To show how this works, let's assume a small spill occurs at a sales terminal having a facility response team organized as described above. For this spill, there are no sensitive areas threatened and no media interest; and the cleanup will only take a day or two. The facility team can easily manage this response. Should a reporter for the local paper

call, the team member assigned as the command staff coordinator would handle the call. Let's say, though, that the spill threatens an endangered species. This may be beyond the capabilities or expertise of the facility's environmental, health and safety coordinator. In addition, because of the threat to wildlife, media interest may be strong. In this case we activate the regional public and government affairs manager, wildlife preservation coordinator, sensitive area advisor, environmental health and safety director, and regional OSC to supplement the facility team. The local spill team's organization easily expands to accommodate the regional team members (Figure 4). Since we are using the incident command system, the regional personnel know where they fit in, who they report to, and what their specific jobs are. The local team members continue to cover all other job responsibilities.

Step 2: Developing contingency plan guidelines. Our next step was to visit each coastal facility to listen to its spill response concerns and needs. This was done in the early part of 1991. These visits resulted in written guidelines to help facility planners develop and write a spill

WESTERN REGION RESPONSE TEAM

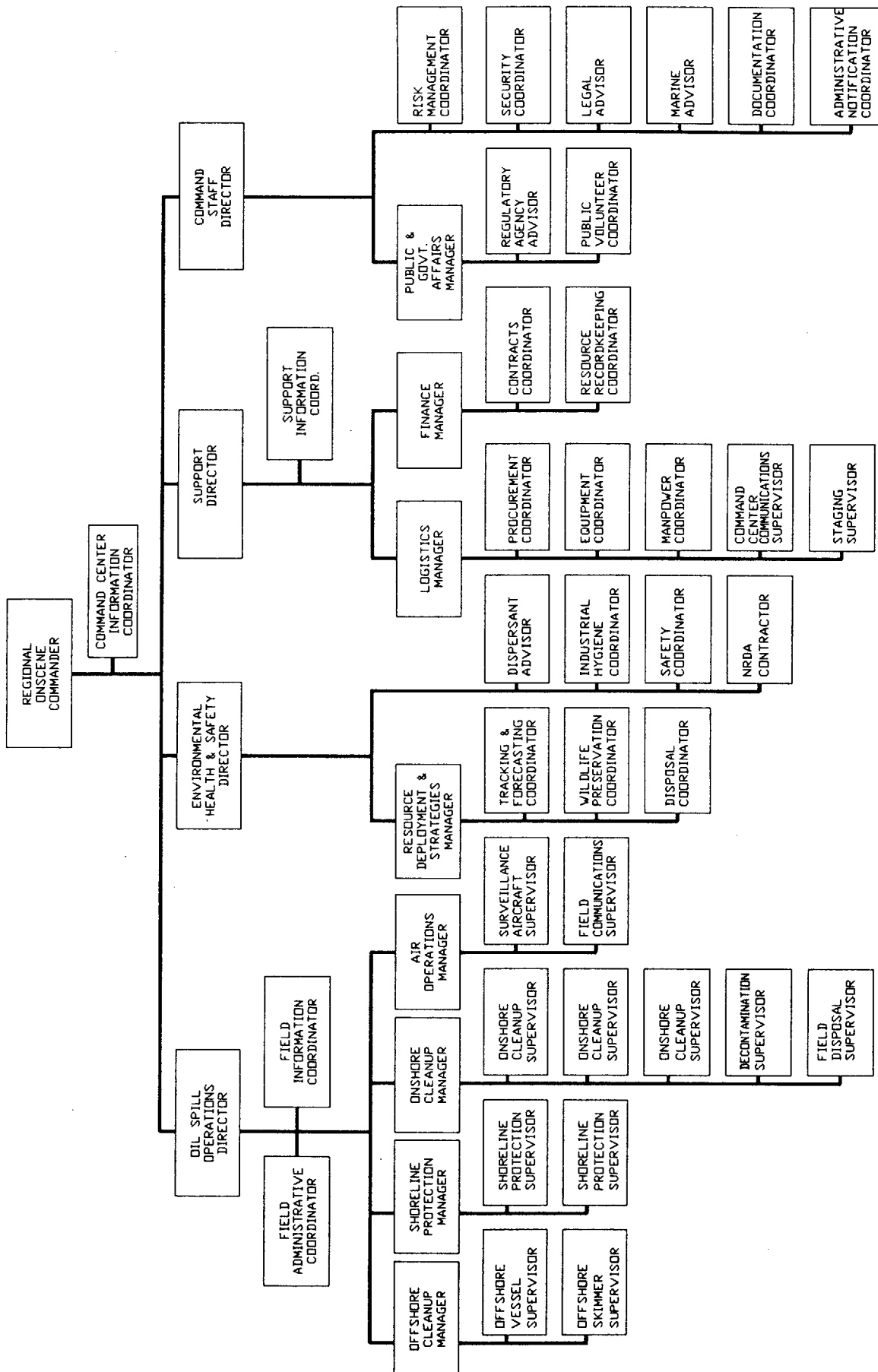


Figure 2. The new Texaco Western Region response team organization

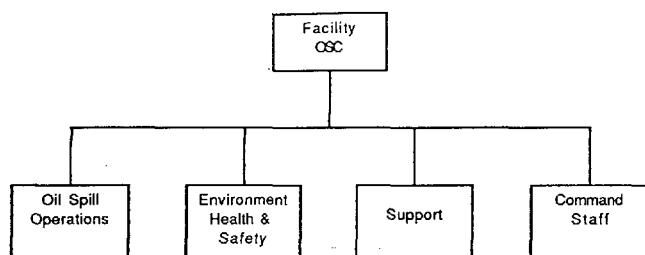


Figure 3. Small facility spill response organization

response contingency plan. Texaco's international oil spill response (IOSR) staff developed a set of corporate guidelines, in May 1991, which included an outline for such a contingency plan. With the guidelines completed, it was time for the next step—a model plan. This required coordination between the IOSR staff, regional OSCs, and facility managers/OSCs.

Step 3: Developing a model contingency plan. Each of Texaco's domestic regional teams has a task force consisting of management level personnel from each operating department. These task forces help the regional OSC develop response plans and resolve issues in dispute. The Western Region OSC suggested to his task force that a contractor produce the model plan. We would base the model plan on an actual plan for one of Texaco's west coast facilities. In addition, negotiations with the contractor would offer later plans to other facilities at reduced costs. This approach provides multiple benefits. First, each facility has the option of having its plan written by a reputable contractor. The facility saves money because of the negotiated reduced cost. It also saves time because it wouldn't have to go through the long bidding process. Texaco ends up with a set of standardized facility response plans. Standardized plans make it easier for Tier II and Tier III members to assist in responding to a facility spill. The task force quickly backed the proposal.

Selecting a reputable contractor was straightforward. We identified 10 firms ranging in size from one-office operations to industry giants. All were well qualified to produce a solid oil spill response contingency plan. Prices for the model plan ranged in cost from unreasonable to out of this world. Our first priority was identifying a contractor willing to

work closely with us in developing a Texaco plan. Many contractors had generic plans they used to help cut costs; but a generic plan did not interest us. We also found that more than one contractor equated spill prevention, control and countermeasures (SPCC) plans with oil spill response contingency plans. Other areas considered included actual oil spill response experience, capability to do multiple plans, oil spill contingency planning experience, capability to meet deadlines, graphics and mapping capabilities, understanding of state and federal laws. After considering all these requirements, we considered costs.

After selecting a contractor, we needed to identify a facility to act as the guinea pig. Because we were creating this model plan from scratch, we knew its cost would be significantly higher than later plans. We anticipated that the lower cost of later plans would make it difficult to find a facility willing to be first. To overcome this, IOSR and the Western Region OSC agreed to share in the cost. Soon after, Texaco's Los Angeles refinery (which includes a marine terminal in Los Angeles Harbor) graciously volunteered.

In December 1991, we held our first meeting at the refinery to define the process to use in developing the model plan. For the project to be successful, key refinery personnel, our Western Region OSC, and the IOSR staff would have to work closely together. Texaco could not sit back and let the contractor do all the work. To accomplish this we would have the contractor work directly with the Western Region OSC and the refinery point of contact. The IOSR staff would coordinate the project and review of the plan overall. With this much involvement, we were able to solve many continuity concerns.

Our first concern was to have standardized plans. The IOSR staff had been working on this issue for some time. As previously stated, it had developed a set of guidelines to help each facility in the development of its specific plan. The guidelines included an outline for a contingency plan; but because of Texaco's corporate structure, the IOSR staff could only recommend that each facility follow the guidelines. By having the Western Region OSC and the IOSR staff working with the facility and the contractor, we were able to convince each facility to adopt a standard format. This entailed many phone calls and meetings, especially by the Western Region OSC, but the results were well worth it.

Some minor problems came to light when presenting the model plan to other facilities. While most bought into the project readily, a few didn't. Those dissenting had problems with creating new and comprehensive contingency plans when the largest spill they ever had was only a couple of barrels. We pointed out that it wasn't a good idea to base a facility's spill response preparedness on its largest spill to date. If this reasoning hadn't been successful, we were ready to revert to the old tried and true: "the government agencies are requiring comprehensive, worst case scenario based contingency plans." Thankfully, we never had to use this, although we did mention it to back the first argument.

Our second concern was to have each facility's plan dovetail with the Western Region contingency plan. By having the Western Region OSC working directly with each facility and the contractor, we were able to ensure this. In addition, with their reviews, the IOSR staff provided a quality check on the dovetailing of the plans.

Also of concern was facility personnel knowing what information was going into the plan. When we approached the personnel at each facility with the project, we stressed the importance of their involvement during the development of their plan. The natural tendency was to allow the contractor to do all the work and not look at the plan until the submission of the final draft. Again, by working closely with the facility and the contractor, we were able to overcome this tendency.

Next, we wanted to be sure to meet all state and federal laws and regulations. This was the most difficult part of the project, since most of the regulations haven't been written yet. When the project began, only Washington State had regulations in place and a set of guidelines available. We also knew of the involvement of Alaska, Washington, Oregon, and California with the States/BC Task Force. This task force had formed a strong communications link among the west coast states. Given this, we were reasonably sure the regulations eventually developed by each state would be somewhat compatible. Oregon has since adopted regulations nearly identical with Washington's. In addition, Washington and California are actively involved in the federal negotiated rule-making process. This involvement has allowed them to gain valuable insight as to what direction the federal regulations will eventually take. Given all this, we decided to use the Washington regulations and guidelines in developing our model plan, realizing that we'll have

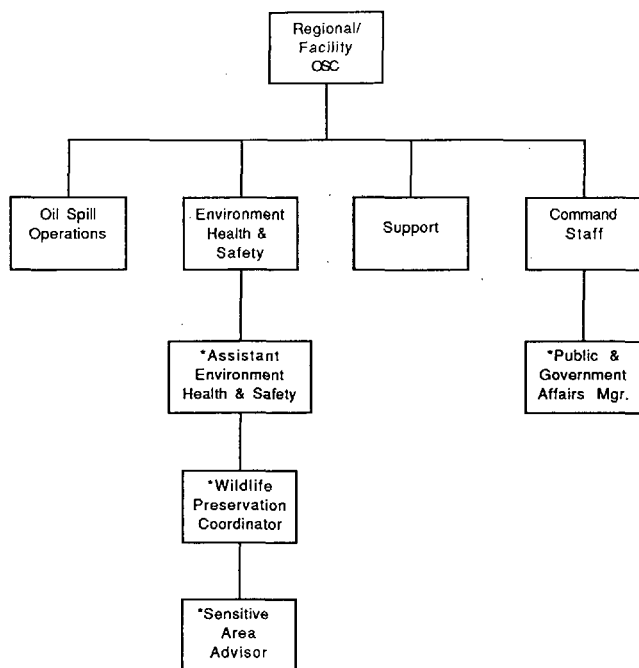


Figure 4. Expanded small facility response organization (* denotes regional team member)

to go back and make some corrections. We feel quite confident that these changes will only be minor.

Finally, the customers—the facility and Western Region response team members—need useful information in the plan. We never lost sight of the main purpose of having a facility oil spill response contingency plan: to prepare Texaco for responding to any spill at our facility quickly, efficiently, safely, and with the least amount of damage to the environment. We will ensure that we meet all regulatory obligations; but this is a secondary goal. If we don't exactly follow the agency recommended format, so be it. Team members using the plans will need certain information quickly and accurately. In an emergency we don't want our responders wasting valuable time thumbing through a manual filled with extraneous information that's only there to satisfy a regulatory requirement. To help the responder, we placed most of the nonemergency information in appendices. It follows, however, that if we meet our primary goal, we will also meet our secondary goal.

Conclusions

We completed the major part of the work on the model plan format in March 1992. In the meantime, we knew the State of Washington deadline for facility plan submittal was May 5. Given this, we began work on our Puget Sound plant and Seattle terminal contingency plans concurrently. We began gathering the necessary data on the two facilities in January. In March we began plugging this information into our just completed model plan format. Using this format, we easily completed both plans before the deadline. The Washington State Department of Ecology has accepted both plans and is currently doing their formal review of each.

We are now developing other plans, using the model plan format, for our Portland, Oregon; Richmond, California; Honolulu and Hilo, Hawaii, sales terminals; our Bakersfield, California, refinery; and our Kern River and offshore California producing fields. We expect to complete these plans by December 31, 1992, well before the OPA 90 contingency plan requirements go into effect.

All these plans meet the goals discussed above. Each follows the standard format and dovetails with the Western Region plan. In addition, each facility has adopted our modified incident command system.

Finally, we estimate a savings of nearly \$100,000 in overall contractor cost. The savings come mostly from using the one standard format. When one considers the additional cost of each facility bidding out the job, hiring its own contractor, and developing its plan from scratch, the savings are even greater.

Our next step is to begin testing the new plans. We have a major spill response exercise scheduled for September 1992, at the Los Angeles plant. The exercise will test how easy the local facility spill team members find the plan to use, and how well it actually dovetails with the regional plan.

Without the concerted effort by all parties associated with this project, we would not have come as far as we have. By visiting each of our facilities, Texaco's IOSR staff and Western Region OSC were able to learn of each facility's problems and concerns. With this understanding, we were able to sit down and develop a strategy for meeting federal and state laws and regulations while also meeting the requirements of the local facilities. This cooperation resulted in standardized facility

plans that will make it much easier for Texaco to respond quickly, safely, and efficiently to a spill incident.

There is one other important point to make. Several times I have mentioned that we wanted to meet all federal and state regulations. Meeting regulations that are still under development is obviously a difficult goal. To overcome this, Texaco has taken an active role in promoting a positive working relationship with the government agencies involved in pollution response. We have done this in many ways. Members of the IOSR staff are participating in federal negotiated rule making. Our Western Region OSC is participating with the California rule-making process. The Western Region OSC and the IOSR staff attend many of the Region IX (southwest including California) and Region X (northwest including Washington and Oregon) regional response team meetings. In addition, our Western Region OSC has attended the annual State's/BC Task Force meeting. By attending these forums, we are able to follow closely the development of the various federal and state requirements. This has contributed to our analysis of which direction the final federal and state regulations will take. As a result, we are confident of the acceptance of our basic plan format. A side benefit of attending regional response team meetings is that we now know who the key government players are and they know who we are. Should an incident take place, there won't be any fumbling around trying to figure out who's who or what to expect from each other.

Acknowledgments

Special thanks to Mark Weller, Texaco's Western Region OSC, for his help in seeing the contingency plan project through; Jim Clow with Texaco's international oil spill response staff for reviewing and offering suggestions for this paper; Ed Labuda, also with Texaco's international oil spill response staff, for his help in developing the Texaco contingency plan guidelines; and Robert J. Meyers of Robert J. Meyers & Associates for his assistance in developing the Texaco contingency plan format.

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ENHANCING CANADA'S SPILL RESPONSE CAPABILITY: OIL SPILL EQUIPMENT REQUIREMENTS FOR A 10,000 TON RESPONSE CAPABILITY

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ABSTRACT: *Oil spills in the past several years have focused considerable attention and public concern on marine environmental issues. The Public Review Panel on Tanker Safety and Marine Spills Response Capability and a Government of Canada internal review, coupled with independent studies, highlighted the fact that Canada's existing spill response capability requires improvement. Among its conclusions, the panel report recommended that a figure of 10,000 tonnes (metric tons, t) be used for planning the establishment of a response capability in each Coast Guard region.*

The study identified in detail the equipment needed to respond to a 10,000 t oil spill by examining four areas: the operating environment, containment and recovery equipment, the temporary storage of recovered oil and water, and the support equipment needed to provide an efficient operation.

Oil spills in the last several years have focused considerable attention and public concern on marine environmental issues. Accidental spills, as well as the intentional discharge of oil, are chronic problems in the marine transportation industry. The Public Review Panel on Tanker Safety and Marine Spills Response Capability and a Government of Canada internal review, coupled with independent studies, have highlighted the fact that Canada's existing spill response capability requires improvement. Among its conclusions, the panel report recommended that a figure of 10,000 tonnes (metric tons, t) be used for planning the establishment of a response capability in each Coast Guard region, and that improvements should be funded and operated by the private sector.

A Canadian Coast Guard working group was given the task of determining what equipment was needed to respond to a 10,000 t oil spill. The work group focused on four areas: the operating environment, containment and recovery equipment, the temporary storage of recovered oil/water, and the support equipment.

In considering the operating environment, we developed three spill models: one for unsheltered waters, one for sheltered waters, and one dealing with shoreline treatment. Unsheltered waters, primarily offshore, require ships or large boats to support operations. In sheltered waters, operations can be carried out with minimum disruption by weather or sea state. Small craft (20 to 30 ft boats and 40 to 50 ft self-propelled barges) can operate safely in this environment. Shoreline

operations are conducted primarily in the intertidal zone between maximum low tide and maximum high tide, including the back shore area affected by storm conditions. Some on-water capability is required during shoreline treatment operations due to the rise and fall of the tide and from flushing of oil from the shore.

This paper provides the details of equipment required to respond to a 10,000 t spill in each individual operating environment. However, in reality a 10,000 t oil spill could effect all three environments simultaneously. Therefore, in developing a response plan for a particular geographic area, it is first necessary to determine the percentage division of operating environments that reflects the normal environmental and geographic conditions of the region. For example a geographic area of response may require 20 percent of the response for unsheltered waters, 30 percent for sheltered waters, and 50 percent for shoreline treatment operations.

Determining the quantity of containment and recovery equipment required to respond adequately to a 10,000 t marine oil spill is a complex undertaking. The operating environment, type of oil, geography, and remoteness of the incident are some of the factors affecting the task. In addition, performance data on oil spill equipment—documented during actual incidents—is often incomplete or inconsistent, and, particularly in the case of skimmers, differs considerably from the manufacturer's rating. To estimate equipment performance, it is necessary to rely on operational experience supplemented with some reasonable planning assumptions.

The quantity of containment equipment needed was calculated by determining that 100 t of oil is contained by 500 meters of boom deployed in a circle if the oil is 5 mm thick. Therefore, 50,000 meters of boom, in 500 meter deployments, is needed to contain 10,000 t of oil. However, oil will normally be contained in an enclosure consisting of both boom and shoreline. Therefore, in reality the amount of boom required to contain 10,000 t of oil is 35,000 meters (Appendix I).

The number of skimmers required in a cleanup operation depends upon many factors. First of all, there are many types of skimmers. While they appear to use a wide variety of methods to recover oil from the water's surface, they can generally be grouped into four categories: weir, belt, disc, and vacuum. Their operating efficiencies vary widely depending upon the environmental conditions and the type of oil encountered.

Manufacturers rate skimmer capacity based on test tank performance only. This rating generally corresponds to the maximum output

of the skimmer discharge pump. However, over the life of an oil spill a variety of conditions are encountered. The properties of oil on the water's surface change with time due to evaporation, dissipation, and emulsification. The spreading slick increases travel time between cleanup sites, interim storage centers, and the base of operations, which in turn, reduces actual skimming time. In addition, operator error, down time for maintenance, and lack of tank space for recovered oil could further reduce skimmer efficiency. As a result, the skimmer's capability to recover oil is not the same as the skimmer's rated capacity; and the per-hour recovery rate, when prorated over the life of the spill, is greatly diminished.

While extensive test data are available on some skimmers, the absence of a universal test protocol that considers such things as the changing properties of the oil, environmental conditions, and logistical problems prohibits assigning realistic oil recovery rates. The American Society For Testing And Materials (ASTM) is developing a test protocol by which all skimmers can be tested and rated. In the interim, a derating factor must be applied to the manufacturer's rated capacity if the skimmers' recovery rates are to form the basis for determining the number required for oil spill response operations. For planning purposes, all skimmers were derated to 20 percent of the manufacturer's stated recovery rate, and calculations were based on a 10-hour operational day.

Temporary storage of recovered oil/water mixtures presents many problems. For planning purposes, the skimmers were derated to 20 percent of the manufacturer's rated capacity; but during actual operations, they discharge at 100 percent capacity. A high percentage of the recovered oil/water mixture is water. Decanting is a slow process requiring storage capacity far in excess of the amount of oil spilled.

Primary storage is required at the skimmer. Fifty t capacity barges were chosen for this purpose because of their ease of handling by smaller boats and their transportability by land to the spill scene. To maximize storage capacity for recovered oil, secondary storage capacity is required. Here the recovered oil/water mixtures are deemulsified and the water decanted. These secondary interim storage centers must be equipped to process at the rate of 100 percent of the hourly recovery rate of the total number of skimmers.

The amount of support equipment needed for sheltered and unsheltered waters depends on the number of skimmers. The amount of support equipment needed for shoreline treatment operations is based on the number of workers required. Details regarding support equipment are provided in the remainder of the paper.

A preliminary costing of the equipment requirements concluded that an investment of approximately \$25 million is required to have a pollution countermeasures capability to address a marine spill of 10,000 t. This cost estimate is based on using a mix of equipment from each operating environment.

This paper identifies the types and quantities of: containment and recovery equipment, water craft, temporary storage requirements for recovered oil/water, and miscellaneous support equipment needed to provide an efficient operation.

Planning assumptions

To determine the equipment and resources needed to respond to a 10,000 t oil spill, it is necessary to make some practical assumptions based on field experience, known performance, and other relevant factors.

- Equipment would be designed for oil and oil products as defined by Marpol.
- Equipment to be used during recovery operations in unsheltered waters must be designed for, but not limited to operations in Beaufort Force 5: wind, 20 kts; wave height, 2 meters.
- When developing the specifications for equipment, consideration should be given to portability; that is, how will the equipment's size and weight affect its transportation by air, land, and/or sea to the equipment staging area for the oil spill, or to the actual site of the spill.
- Response strategies are based on the use of vessels and aircraft of opportunity as detailed in the response plan. A list of suitable vessels will be maintained in the response plan, and updated every six months.

- An average operational day is 10 hours. This time frame is based on the average of seasonal lengths of day and health and safety concerns.
- Recovery in unsheltered waters would be completed within 10 operational days.
- Recovery in sheltered waters would be completed within 30 operational days.
- Shoreline treatment would be completed within 365 calendar days.
- For planning purposes, emulsification is offset by evaporation and natural dispersion.
- Dispersants have not been considered as a countermeasure technique in this paper. Equipment for dispersant application will be addressed as a separate issue.
- Provision for in situ burning has not been made in this paper. Burning oil on water techniques are still being developed. Research projects are presently studying the feasibility of this technique.
- The salvage of the ship or any remaining cargo is not addressed in this paper.
- Response strategies are based on the use of industry and government technical and environmental services.
- Response capability and strategies for the Arctic will be addressed as a separate issue.
- All fractional results of calculations are rounded upward.

Unsheltered waters

Objective. To recover 10,000 metric tons (t) of weathered oil from unsheltered waters in 10 days

Response strategy. Ship-mounted sweep and skimming systems will be used to recover the oil. Thirteen such systems will be required. Operations in unsheltered waters will be conducted from ships capable of operating safely in this environment, large ships (offshore supply vessels) are required for operations more than 40 kilometers from shore and smaller boats (65 to 100 ft fishing vessels) may be used in operations within 40 kilometers of shore. These are only two examples, other ships suited to this type of operation may be used.

The offshore supply-type vessels, chartered as vessels of opportunity, will be equipped with a sweep system consisting of boom, skimmer, and two 25 t settling tanks. Such vessels are chosen for their on-board storage capacity of more than 100 t. When the vessel's storage tanks become filled with recovered oil, skimming operations stop and the vessel proceeds to a processing/interim storage facility to discharge the recovered oil. After discharge of the recovered oil, the ship will return to the spill area and resume sweep and skimming operations.

The processing/interim storage facilities will consist of a 10,000 t tanker or barge with the equipment needed to begin processing the recovered oil/water mixture. The primary processing will deemulsify the mixture and decant the water.

The fishing vessels, chartered as vessels of opportunity, will be equipped with a scaled-down sweep system consisting of boom and skimmer. As the on-board storage capacity is limited and discharging at the processing facility would result in frequent interruptions of recovery operations, floating tanks (50 t dumb barges) capable of being towed by the vessel are needed. Fifty ton capacity barges were chosen for their ease of handling by the smaller boats and their transportability by land to the spill scene. However, because of their limited storage capacity a minimum of three barges per sweep system is required to maintain an efficient skimming operations.

A second boat of sufficient size and horsepower is also needed to shuttle the barges to the processing/interim storage facilities. This operation is carried out as follows: while one tank is being filled by the skimmer, one is full and in tow by the shuttle vessel to be emptied, and the other tank is being emptied at the processing/interim storage facility.

To gain the greatest efficiency during unsheltered waters operations, spotter aircraft should be used to locate the oil and direct the ships.

Response equipment. Large, open-sea vessels and smaller, 65 ft fishing boats may both be needed. The sweep method requires that vessels used in deploying the system operate at low speeds (1.5 knots)

for extended periods of time. Variable pitch propeller ships and boats may be needed to meet this requirement. Availability of such vessels will need to be identified in response plans.

Large ships must be equipped with a sweep system consisting of boom, skimmer, jib, and associated equipment. If the oil is concentrated and environmental conditions permit, additional boom can be deployed and the oil recovered in the static mode. Other requirements include:

- Internal storage, 100 t minimum capacity,
- Settling tanks on deck, 50 t capacity, and
- Oil spill response technicians, 5 per ship.

Small ships must be equipped with a similar, scaled-down sweep system. Other requirements include:

- Oil spill response technicians, 5 per system;
- Dumb barges, 50 t, 3 per system;
- Shuttle tug/system (45 ft fishing boat), 1 per system for towing dumb barges; and
- Oil spill response technicians, 3 per shuttle tug.

Recovery calculation. Using a skimmer rated by its manufacturer at 40 t per hour, a recovery rate of 80 t per day is assigned for planning purposes by applying the derating factors of 20% of manufacturer's recovery rate and a 10 hour day.

Therefore, if one system has the capability of collecting 80 t per day, 13 systems are needed to collect 10,000 t in 10 days.

Equipment inventory required. Table 1 shows the equipment needed and its cost.

Sheltered waters

Objective. To contain and recover 10,000 t of weathered oil from sheltered waters in 10 days

Response strategy. Operations in sheltered waters will be conducted from self-propelled barges capable of providing a safe working platform for five oil spill recovery technicians (OSRT), a skimmer, and associated equipment. Landing craft style barges in the 40 to 80 ft range are most suited for this work because their design permits working in shallow water. The skimmers are deployed from these barges and the recovered oil is pumped into dumb barges with storage capacities less than 50 tons. The dumb barges, when full, will be shuttled to the processing/interim storage facility by a shuttle tug.

Response equipment.

- Containment boom Type I and II
- Self-propelled barges (30 to 80 ft) 5 OSRTs per barge
- Dumb barges 50 t
- Boats (20 to 30 ft) 3 OSRTs per boat
- Ancillary equipment (lights, generators, etc.)
- Portable storage tanks
- Skimmers (assorted weir, rotating disc, rotating belt, and vacuum)
- Chartered shuttle tugs, one tug per 3 dumb barges, 3 OSRTs per shuttle tug

Recovery calculation. Using a skimmer rated by its manufacturer at 40 t per hour, a recovery rate of 80 t per day is assigned for planning

Table 1. Equipment inventory required for response in unsheltered waters

Equipment	Number	Total cost ₁
Skimmers c/w associated equipment	13	1,950,000
Sweep systems c/w boom, jib, and associated equipment	13	1,950,000
Ships	4	Charter
Portable tanks, 5,000 gallons (1 per large vessel)	4	80,000
Fishing boats	9	Charter
Poll-u-tanks (3 per small vessel)	27	2,430,000
Oil spill response technician personnel kit	92	46,000
Total		6,456,000

1. In Canadian dollars

Table 2. Equipment inventory required for response in sheltered waters

Equipment	Number	Total cost ₁
Skimmers, c/w associated equipment	13	1,950,000
Self-propelled barges, c/w small crane/derrick	13	2,600,000
Dumb barges, 50 ton capacity	39	3,900,000
Boats, 20 to 30 ft	13	650,000
Containment boom Type I	21,000 m	2,100,000
Containment boom Type II	10,500 m	7,875,000
Type I boom accessories (one kit/200 m)	114 kits	400,000
kit: towing attachments	2	
anchoring attachment	2	
anchors	2	
rope, 1/2 in poly	50 m	
spare shackles	20	
chain, 3/8 in	6 m	
Type II boom anchors	24	50,000
Oil spill response technician personnel kit	104	52,000
Processing/interim storage centers	2	
Total		19,577,000

1. In Canadian dollars

purposes by applying the derating factors of 20% of manufacturer's recovery rating and a 10 hour day.

Therefore, if one system has the capability of collecting 80 t per day, 13 systems are needed to collect 10,000 t in 10 days.

Equipment inventory required. See Table 2.

Shoreline treatment

Objective. To treat 450 km of shoreline, contaminated by a 10,000 t spill, in 300 days

Response strategy. As much of our coastline is inaccessible by road, shoreline treatment operations will require extensive use of self-propelled barges. These barges will transport equipment and personnel to cleanup sites. Where possible, oil stranded on the shoreline will be flushed off the beach into the water and contained by booms. The oil will be recovered by skimmers deployed from the self-propelled barges.

Recovered oil will be transferred into temporary 1,000 gallon storage tanks located on shore. This oil will be collected by self-propelled barges with 5,000 gallon storage tanks on board, and taken to processing/interim storage facilities.

The processing/interim storage facilities will have the capability of off-loading oil from the self-propelled barges and the floating storage tanks (described in the unsheltered waters scenario) using portable submersible pumps, de-emulsifying equipment, oily-water separating equipment, and a steam boiler to heat the oil to assist in pumping.

Response equipment.

- Containment boom Type I and II (Appendix II)
- Self-propelled barges (30 to 80 ft) 5 OSRTs per barge
- Boats (20 to 30 ft), 3 OSRTs per boat
- Ancillary equipment (lights, generators, etc.)
- Dumb barges
- Chartered shuttle tugs, one per 3 dumb barges, 3 OSRTs per tug
- LCM barges, 5 OSRTs per barge
- Skimmers and associated equipment
- Portable storage tanks, 5,000 gal
- Portable storage tanks, 1,000 gal
- Sorbent
- Pumps—low pressure and high volume
- Pressure washers
- Steam boilers



- Rakes
- Shovels
- ATV c/w trailers
- Incinerators, 2 OSRTs per incinerator
- Portable air fans

Treatment calculation. If 1,500 meters of shoreline needs to be treated per day to meet the 300 day objective, and, one oil spill

Table 3. Equipment inventory required for response along shoreline

Equipment	Number	Cost	Total cost ₁
Self-propelled barge	1	200,000	
Pumps (low pressure and high volume)	5	20,000	
Pressure washers	2	10,000	
Skimmer	1	50,000	
Dumb barges, 50 t capacity	3	300,000	
OSRT personnel kits	25	12,500	
		296,000	
Total for 13 teams			3,848,000
LCM barges c/w small crane or derrick	4	2,000,000	
Portable tanks, 5,000 gal	4	40,000	
OSRT personnel kits	20	10,000	
			2,050,000
Other equipment			
ATVs c/w trailers	15		150,000
Boats (20 to 30 ft Boston Whaler type)	15		750,000
Incinerators	15		1,000,000
Portable air fans	50		250,000
Rakes	250		2,500
Shovels	250		2,500
Boom Type I c/w accessories	21,000 m		
Boom Type II	10,500 m		
Sorbent			
100,000 plastic bags	500,000		15,000
Processing/interim storage centers	2		
Total			8,068,000

1. In Canadian dollars

Table 4. Requirements for the secondary interim storage/processing center and other support equipment

Equipment	Number	Total cost ₁
Interim storage/processing center		
Tanker or barge, 10,000 t	2	Charter
Submersible pumps	4	600,000
100 hp steam boiler	1	150,000
Deemulsifying system	1	200,000
Oil/water separator system	1	200,000
Oil spill response technicians	5	
Other support equipment		
6 in floating discharge hose	1,000 ft.	100,000
4 in floating discharge hose	1,000 ft.	75,000
Forklift trucks	2	150,000
Response vehicles (4 × 4 crew cab pickup)	2	50,000
Portable operations center (40 ft Atco trailer c/w standby generator and communication equipment)	1	100,000

1. In Canadian dollars

responder can clean 6 meters of shoreline per day, then 250 oil spill responders can treat 450 km of shoreline in 300 days.

If each team consists of 18 oil spill responders, 13 shoreline treatment teams will be required.

Equipment inventory required. Thirteen shoreline treatment teams will be required. Each shoreline treatment team will consist of 18 oil spill responders (beach crew), 2 supervisors, 5 OSRTs (barge crew), and the equipment listed in Table 3.

The equipment needed for the secondary, interim storage/processing center and other support activities is shown in Table 4. Contract agreements must be made for tractor trailers, aircraft (transport and surveillance), vessels of opportunity, and labor.

Appendix I Boom containment calculation

Containment boom, 500 meters long, deployed in a circle

$$\begin{aligned} C &= \pi d & V &= \pi r^2 \times h \\ 500 \text{ meters} &= 3.14 \times d & &= 3.14 \times 80^2 \times .005 \text{ meters} \\ d &= \frac{500}{3.14} & &= 100 \text{ cubic meters} \\ d &= 159.23 \\ r &= 79.61 \sim 80 \end{aligned}$$

The volume of oil, with average thickness of 5 millimeters, that can be contained in 500 meters of boom is 100 cubic meters.

Then 50,000 meters of boom deployed in 500 meter deployments will be required to contain 10,000 tons.

But if the oil will be contained in an enclosure consisting of a length of boom and the shoreline; and assuming that the average enclosure is composed of 70% boom and 30% shoreline, then the containment boom required would be:

$$50,000 \text{ meters} \times 70\% = 35,000 \text{ meters.}$$

Appendix II Boom deployment breakdown

Type	Percent	Estimated quantity
Type I boom		
Sheltered water	60	21,000 m
Deployed near shore, in coves and harbors		
Cost approx. \$100/m		
18 to 36 in OAH		
Type II boom (heavy duty boom)		
Unsheltered waters	30	10,500 m
Deployed offshore or across the mouth of harbors or small bays; may be exposed to rough sea conditions		
Cost approx. \$750/m		
2m OAH		
Type III boom		
Sweep systems	10	3,500 m
Deployed from and remain attached to boats or ships. Boat and ship size can vary from 65 ft fishing vessel to 300 ft OSV. Quantity of boom per vessel would be minimal; the vessel would steam into a slick and collect the oil in the apex of the boom where it would be recovered by a skimmer		
Total	100	35,000 m

Appendix III**Kit to field one oil spill response technician₁**

Quantity	Item	Cost ₂
1	duffle bag	20
1	rain suit	50
1	rubber boots	50
1	life jacket	30
1	rubber gloves	100
1	cloth gloves	
1	hard hat	5
1	coverall	25
1	exposure suit	150
	Total	410
For every 9 workers, 1 supervisor is required.		
Kit required to field one supervisor		
1	hand-held radio	2,500
1	kit from above	410
		2,910

1. The above kit is for issue to OSRTs when they are taken on; it does not take into consideration replacement due to normal wear and tear.

2. In Canadian dollars

MUTUAL AID IN OIL SPILL RESPONSE: THE ALASKAN NORTH SLOPE MODEL

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ABSTRACT: *The Alaskan Arctic Region provides one of the world's most remote and challenging environments in which to mount an oil spill response. To facilitate the timeliness and appropriateness of the response, Alaska Clean Seas (ACS) and the operators of the North Slope oil fields have implemented a mutual aid concept for spill response. The concept is based upon each operator on the North Slope maintaining its own inventory of personnel [a spill response team (SRT)] and equipment that is available on short notice to respond to a spill. If the spill exceeds the responsible operator's resources, additional resources can be obtained from other operators and/or ACS through mutual aid. Individuals from diverse organizations are brought together in a mutual aid event. To allow different organizations to function effectively in a multi-organizational environment, a common management structure was required. The structure chosen for the North Slope was the incident command system (ICS).*

A key concern when discussing mutual aid is the provision of indemnification from liability for responders. For the North Slope, ACS and its member companies are indemnified when responding to a spill through provisions in the ACS charter and the ACS response action contract.

The North Slope of Alaska presents unique challenges and opportunities for spill response. On one hand, long, cold winters facilitate natural containment and minimize spreading of spills on the land and ice. On the other hand, climatic extremes require unique safety and operability concerns for both personnel and equipment. Winter air temperatures can drop as low as -60°F and with a stiff wind blowing the chill factor can fall to -135°F . For two months in midwinter, the sun never rises above the horizon.

Due to the sensitive nature of the terrain, travel with heavy equipment is restricted to existing roads, pads, and winter ice roads. Only specially designed vehicles that exert minimum ground pressure are allowed on the tundra during the summer months. The offshore area is shallow, with water depths less than five feet stretching several miles offshore in many areas. This makes access by conventional vessels difficult. Two major rivers run through the current North Slope fields. Both are shallow, highly braided, fast moving rivers that are susceptible to rapid water fluctuations from mountain rains in the Brooks Range some 90 miles south of the coast. In short, a challenging environment.

The North Slope of Alaska is biologically productive during the short summer season. Millions of birds make their home there during the summer. They come to nest and raise their young, molt, or simply pass through on migration. Large herds of caribou migrate to the area in summer and significant numbers of musk oxen, polar bear, and brown bear inhabit the area year round. Offshore, migrations of beluga and bowhead whales occur in both the spring and fall.

The Inupiat people who inhabit the area, maintain a close link with the land. Their subsistence lifestyle relies heavily on the natural re-

sources to provide food and raw materials for clothing. Cultural activities are intertwined with seasonal changes.

Four companies operate in the middle of this harsh and sensitive environment. They are involved in the production and transportation of oil from the Endicott, Prudhoe Bay, Kuparuk, Milne Point, and Lisburne fields (see Figure 1). The Trans Alaska Pipeline System (TAPS) carries the oil from the North Slope to Valdez where it is loaded on tankers for shipment to market. Currently, between 1.6 and 1.7 million barrels of oil are produced and transported from the North Slope every day. This is approximately 25 percent of current U.S. domestic production.

All of this means that a prompt and effective response to oil spills is required so that any spills that occur are contained and cleaned up as quickly as possible and damage to the environment minimized. To facilitate this, a system of mutual aid has been developed on the North Slope. To date there have been no major oil spills in this area. This enviable record is attributed to, among other things, the sensitivity of operators to the impact of spills and their ongoing commitment to proactive preventive programs. Additionally, the use of above-ground pipelines and lack of stored oil have generally contributed to a lower than expected incident rate given the throughput volumes considered.

North slope spill response strategy

The response strategy for the North Slope is based on three closely connected and interrelated premises; a strong spill response cooperative (Alaska Clean Seas), a tiered response to all oil spill incidents and mutual aid between the operators. Each of these is discussed in detail below.

Alaska Clean Seas (ACS). Alaska Clean Seas is a nonprofit, unincorporated oil spill response cooperative whose current membership includes oil and pipeline companies that are involved in oil and gas exploration, development, production, and pipeline transport activities on the North Slope of Alaska, and in the leased portions of the Beaufort Sea offshore of the state of Alaska.

In 1990, ACS was restructured from an equipment co-op into a full response organization. Its purpose and mission is to provide materials, equipment, supplies, training, and personnel response capability for use in support of its members. This includes preparing for, responding to, and cleaning up an oil spill within the ACS area of interest. Now organized to respond, like a fire brigade, to an emergency with trained people and equipment, ACS also maintains a role as focal point for spill-related issues of common concern to its member companies. It is active in streamlining approval processes for spill response, providing training, fostering a common organizational structure for responding to spills, and implementing a response plan for spill activities, such as wildlife response, waste disposal, communications, equipment maintenance and tracking.

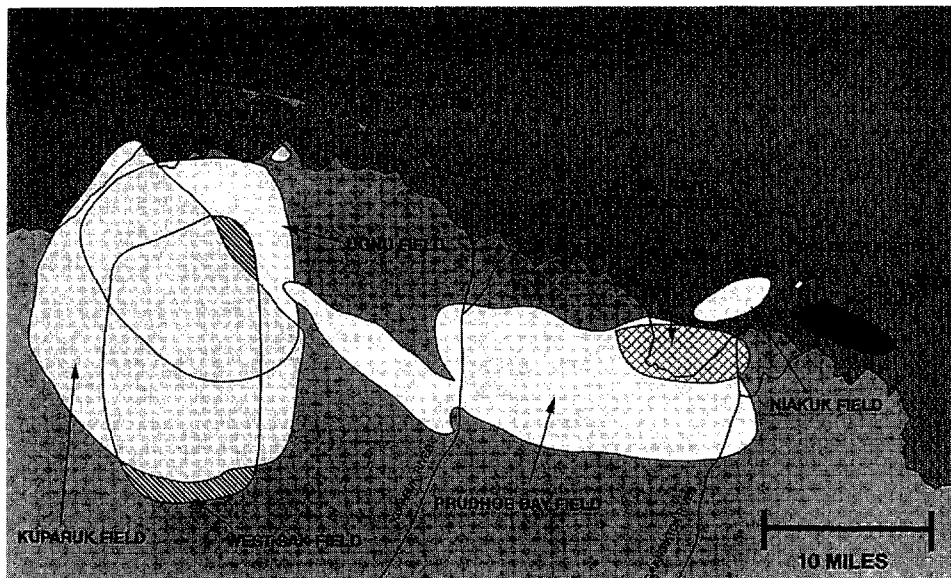


Figure 1. North Slope oil fields

Equipment is owned by the co-op and stored primarily on the North Slope. The inventory includes: approximately 190,000 feet of boom (including 15,500 feet of fire boom); 60 skimmers; 8 helitorch aerial ignition systems; dispersant and application systems; 27 work boats; storage tanks and bladders; wildlife hazing equipment and treatment modules; an incident command post and major telecommunications equipment.

ACS currently maintains a year-round operations staff of at least 11 on the North Slope working 7 days a week, 12 hours a day. Including on- and off-shift personnel on the North Slope and Anchorage headquarters staff, the total organizational complement varies from about 33 in winter to 45 or more in summer. To supplement manpower requirements beyond those provided through the SRTs, ACS maintains auxiliary contract response teams (ACRTs) and village response teams (VRTs). The main ACRT (#1) is made up of contract personnel that work a regular rotation on the North Slope oil field operations, primarily in maintenance or support roles. At least 50 people available at any time from ACRT #1 can respond within four hours of notification. The importance of this auxiliary team is understood by North Slope management; and arrangements are in place for their immediate release from their other duties if required to respond to a spill. Table 1 shows the personnel available from operators and ACS.

VRTs from the local village communities of Nuiqsut and Barrow that can be on site within 24 hours of notification have been formed and trained. In total, 30 village people can be made available from the VRTs. They bring a wealth of local knowledge with them (operational, environmental, and cultural), which is invaluable in responding to spills.

Additional response personnel can be made available from the Anchorage area and other regions of Alaska as required. ACS maintains a contract to have an additional 150 personnel available on site with 24 hours notice. On March 7, 1992, a drill was conducted to confirm the ability of ACS's prime contractor to facilitate a rapid call-out of a contract labor force to respond to a major oil spill. The drill was activated on an unannounced basis by the U.S. Coast Guard. Previous arrangements had been made between ACS and The U.S. Coast Guard to call the drill sometime between February 1, 1992, and March 31, 1992. When the drill was initiated (on a holiday weekend) 2026 calls were made over a period of 9.5 hours. Of those called 831 were available within 12 hours and approximately 40 percent possessed current 40-hour training in hazardous waste operations (Hazwoper). This far exceeded the contractual requirements of 150 people within 24 hours.

Tiered level of response. Spills on the North Slope are categorized into Levels I, II, and III. The levels are determined by the resource

requirements associated with mounting an effective response. The severity of a spill cannot be categorized by size or volume alone. Spill severity is a function of several factors, including the receiving environment, the time of year, the resources at risk, the volume spilled and the type of product spilled. The following spill classes were developed for planning purposes.

- Level I. Can be handled by the spiller with his own immediately available manpower and equipment resources.
- Level II. Requires additional equipment resources or manpower beyond the spiller's immediately available capability, however, not exceeding the combined North Slope resources of the spiller, Alaska Clean Seas, and available mutual aid assistance of the other North Slope operators and companies.
- Level III. Catastrophic spill requiring significant resources from outside the immediate North Slope infrastructure.

To handle a Level I spill each operator on the North Slope has established its own spill response team (SRT). The teams are generally made up of personnel who hold regular full-time positions operating the fields or the pipeline. The teams are structured similarly to volunteer fire teams and emergency medical teams (EMT). A spill chief is designated for each operator on the North Slope. The chief is responsible for coordinating oil spill response and preparedness activities within his field. The SRTs practice and train together as a group on a weekly basis to respond to oil spills. The number of personnel involved in the

Table 1. Summary of personnel available immediately through mutual aid and ACS

Operation/Operator	Number of personnel
Endicott [BP Exploration (Alaska), Inc.]	23
Prudhoe Bay East (Arco Alaska, Inc.)	26
Prudhoe Bay West [BP Exploration (Alaska), Inc.]	50
Kuparuk (Arco Alaska, Inc.)	35
Milne Point (Conoco)	23
Trans Alaska Pipeline System (Alyeska Pipeline Service Co.)	13
Alaska Clean Seas	11
Alaska Clean Seas—ACRT#1	50
Total	231