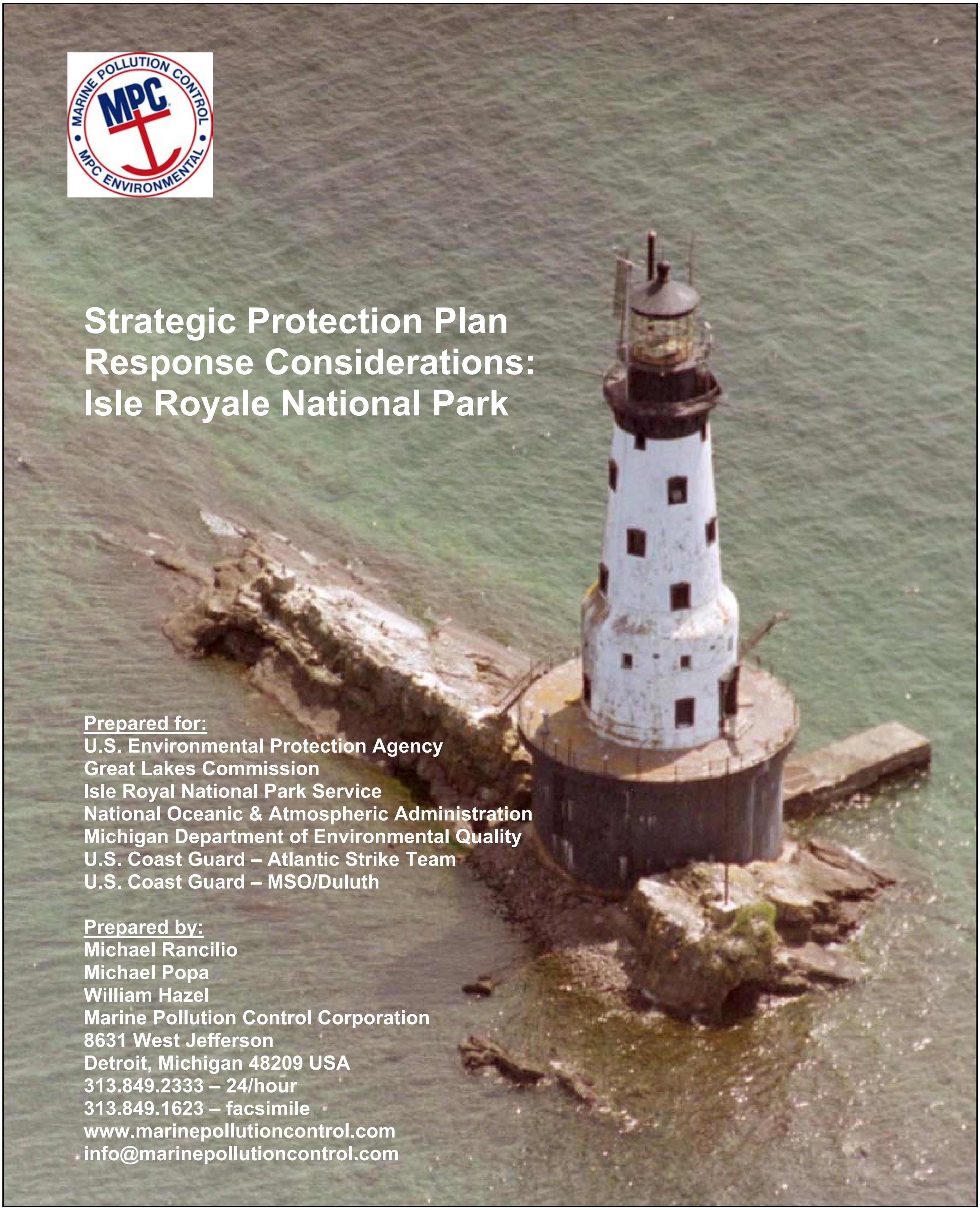

Strategic Protection Plan Response Considerations: Isle Royale National Park

Prepared for:
U.S. Environmental Protection Agency
Great Lakes Commission
Isle Royal National Park Service
National Oceanic & Atmospheric Administration
Michigan Department of Environmental Quality
U.S. Coast Guard – Atlantic Strike Team
U.S. Coast Guard – MSO/Duluth

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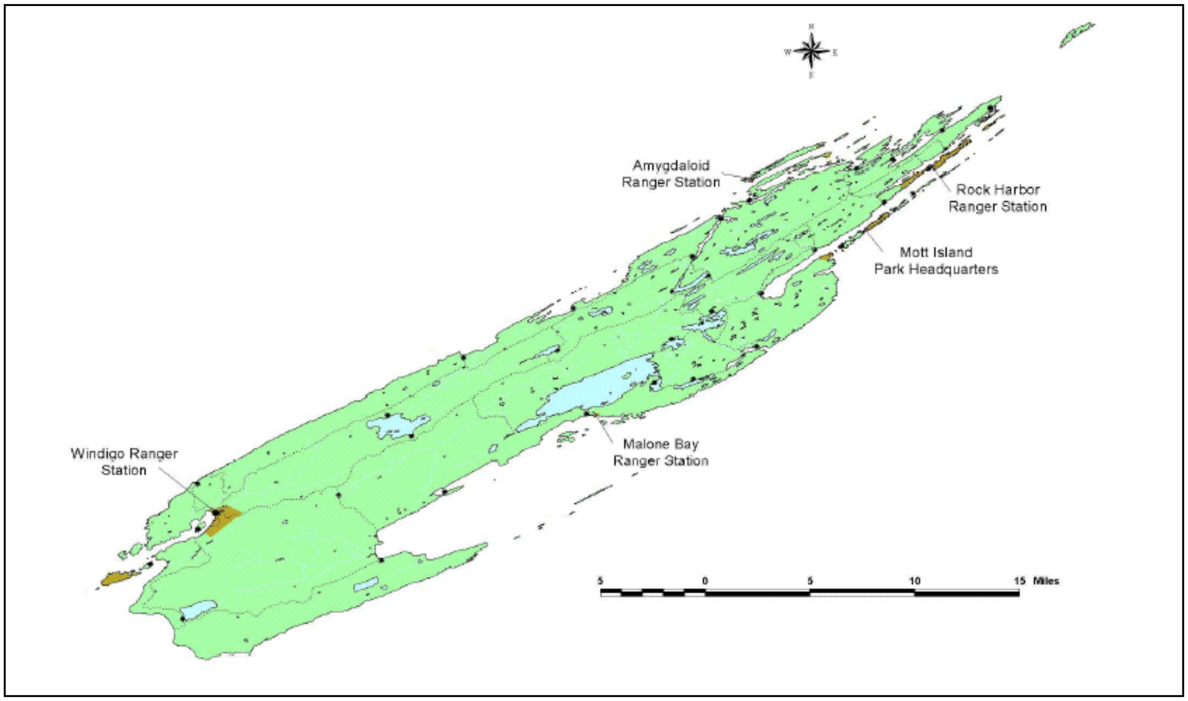


1.0 Scope of Document

On June 11 through13, 2003, representatives from Marine Pollution Control (MPC) participated with other professional spill response and resource conservation experts during a site visit to Isle Royal National Park, located on the northwest corner of Lake Superior. The purpose of the site visit was to gain first-hand knowledge of this pristine wilderness area in order to develop a pilot program to develop a strategic protection plan for the island.

As the National Park Service's (NPS) designated Oil Spill Removal Organization (OSRO), MPC gained a great deal of practical knowledge during the site visit. Working with the team allowed us to become familiar with the specific concerns, tactical objectives, and command and control systems of the main stakeholders involved in the protection of the park; not to mention the invaluable experience we gained by being able to physically see and closely examine many of the conditions present at the site. We also became familiar with sixteen designated areas that the NPS has identified as being high-priority locations for protection operations. The site visit helped us to improve our ability to support the efforts of the NPS's First Response Team.

Our representatives, Mike Popa and Mike Rancilio, came away with several ideas regarding spill response operations and pre-planning initiatives for the island. This report will serve to compile and analyze some of those ideas, and preserve them for possible inclusion in the Strategic Plan (where appropriate), to provide helpful information for the Area Contingency Plan (ACP), to be useful to the NPS in their mission to move forward in their First Response capabilities, or simply for future reference. In pursuing these goals we continually challenged ourselves to place a great deal of importance on protecting and preserving its pristine ecology.

The report is organized in the following manner:

- Section 1.0 – Scope of Document
- Section 2.0 – Overview of the Site Visit
- Section 3.0 – Strengths and Vulnerabilities Associated With The Island
- Section 4.0 – Suggestions on Short Term and Long Term Planning
- Section 5.0 – Recommendations Regarding First Response Operations
- Section 6.0 – Recommendations Regarding WCD Scenarios
- Appendix A – Overview of Various Tactics and Technical Data
- Appendix B – Draft 3-Year PREP Drill Program
- Appendix C – Draft Resource Matrix to Support WCD Operations
- Appendix D – Case Studies (Vessel Grounding Scenarios)

2.0 Purpose and Accomplishments of the Site Visit Team (Brief Overview)

The site visit team consisted of representatives of several organizations, including:

U.S. Coast Guard – Atlantic Strike Team (USCG – AST)
U.S. Coast Guard – MSO Duluth (USCG – MSO)
U.S. Environmental Protection Agency (USEPA)
National Park Service – Isle Royale (NPS – IR)
National Oceanic and Atmospheric Administration (NOAA)
Great Lakes Commission (GLC)
Michigan Department of Environmental Quality (MDEQ)
Marine Pollution Control (MPC)

The mix and makeup of the group was advantageous to our learning process overall, especially in that it consisted of a wide variety of participants representing multiple related disciplines, many of whom were the key players that would be present during an actual spill event. A primary objective of the visit was for the group to collectively and individually make observations of actual conditions present on the island, assess the response capacity of the personnel and equipment currently stationed there, and develop and document as many “real-life” strategies as possible (for inclusion into the Strategic Protection Plan).

From an operational perspective, we feel that the site visit’s main accomplishments were defining and putting into perspective the complexities that would be involved in mounting a response operation at the island. The general consensus is that an enormous effort would be required for such operations to be conducted successfully and, so, the extensive and careful pre-planning this group is undertaking will lead us to arrive at the best level of protection that can be achieved. With this in mind, MPC feels that the site visit provided an excellent start from which additional work and studies may proceed, and set forth the principle guidelines to create a proper frame of reference for that effort.

3.0 Assessment: Specific Strengths and Vulnerabilities Associated with Spill Response Operations Involving the Isle Royale

"On this continent and in the world, Isle Royale is an almost unique repository of primitive conditions. Like a priceless antique, it will be even more valuable in times not far ahead."

-Durward Allen, Wolves of Minong, 1979

When visiting Isle Royale, the intrepid adventurer immediately conjures words to describe his or her experience that are similar to those expressed by Durwood Allen, so majestic and exotic are the sights and sounds presented. The island is indeed a national treasure, simultaneously possessing both pristine wilderness and the ruins of previous attempts to populate the land and harness its resources. As one park publication candidly points out, "After centuries of struggling to subdue and live on Isle Royale, humans now struggle to preserve the island."[1]

This last statement makes a fitting introduction to our purposes herein, and is offered as such in order to make present in the mind of the reader the fact that the environment we are discussing represents a natural resource that is both priceless and irreplaceable. This is a point that will not be lost on responders when dealing with an oil spill in the vicinity of Isle Royale, and one which will never be far away from the thoughts of those individuals conducting the negotiations that will take place when developing and implementing containment and recovery tactics, protective strategies, manpower decisions, and all of the other manifold and interrelated operational aspects that comprise a full-scale spill response operation. In fact, for both of MPC's representatives that participated in the site visit, the Isle Royale ecosphere invoked strong memories – both positive and negative – associated with the response operations for the Exxon Valdez, which grounded in pristine Prince William Sound, Alaska, in 1989.

Broadly speaking, MPC would cite the following examples as "strengths" regarding the overall capability to mount a spill response operation at the island:

- Response Capabilities (Personnel and Equipment) of NPS-IR: The National Park Service, in keeping with the regulations and intent of the Oil Pollution Act of 1990 (OPA'90), has acquired first response spill equipment and trained some of its personnel on its use. This initiative has positioned the island staff to mount the initial stages of a spill response (both from island-owned oil tanks or from outside spill sources), allowing for some important initial work to be completed while other resources are being mobilized to the site (or when weather or other logistic problems prevents those additional resources from being deployed). MPC believes that this core capability is an excellent

[1] Page 1 – "Isle Royale Long Range Interpretive Plan – 2000"

resource that can be readily and greatly enhanced through pre-planning and other recommendations described below in Section 5.0.

- U.S. Environmental Protection Agency's Inland Sensitivity Atlas: The importance of this pre-planning documentation cannot be overstated; the Inland Sensitivity Atlas produced by the USEPA is an invaluable tool for spill responders working at the Isle Royale site. By pre-identifying environmentally- and economically-sensitive areas, shoreline types, potential spill sources and other information in an easy to use electronic format, spill responders will be able to quickly and effectively make crucial tactical decisions based on reliable and comprehensive data.

- Increased Awareness of the Island's Vulnerability and the Need For A Coordination of Effort Between Major Stakeholders (as evidenced by the present site visit and GLC project): MPC recognizes that the coordinated effort by a number of stakeholders who share a vision of protecting this environment represents a positive movement in spill response readiness for the Lake Superior area. Although much of the nation's spill response program is based on the concept of placing responsibility on the community of potential Responsible Parties (RPs) doing business on or near US waterways, the recognition of this group of organizations – particularly the NPS - demonstrates a commitment to the principles of OPA '90 above and beyond the mere "letter of the law." In this regard, Isle Royale's overall plan may form, in our opinion, a unique approach to environmental stewardship within this specific ecosystem by introducing an initiative that creates a special version of OPA '90 for the Great Lakes; one that provides a strategic level of protection for this region where OSRO services are limited due to the lower amount of OPA'90-regulated vessels (i.e., bulk oil tankers) that traverse local waterways, but which still are at threat of a major spill from non-regulated ships (i.e., bulk cargo ships such as ore carriers, etc.).[2]

Vulnerabilities, "weaknesses", and critical response operation objectives:

- Remote Location: As we will discuss in greater detail below, a major oil spill impacting Isle Royale will require substantial amounts of containment boom (>25,000 feet could be required for a large spill), hundreds of response personnel, tons of additional equipment, hundreds of thousands of gallons of

[2] This threat from non-OPA'90 regulated vessels should not be understated. Many of the major vessel groundings and/or oil pollution incidents that have occurred in US waters within the last ten years are from ships that were not required to have OPA'90 vessel response plans identifying dedicated resources on board (i.e., the *M/V* Firat, Florida, 1994; the *M/V Fortuna Reefer*, Mona Island, Puerto Rico, 1997; the *M/V Kur*oshima, Alaska, 1997; the *M/V New Carissa*, Oregon, 1999; etc.). Adding to this problem is the fact that oil spills from such vessels normally involve "heavy oils" (No.6 HFO), which can be particularly difficult to effectively respond to, and may in fact sink when spilled in water. Refer to Appendix D for additional information on the four vessel incidents referenced above.

temporary storage capacity, and a fleet of support boats and aircraft. Given that the island is located a considerable distance from the mainland (not to mention lies a considerable distance from any heavily populated area featuring abundant U.S. shore side infrastructure), the primary obstacle for mounting a major spill operation will revolve around how to best and most rapidly establish, and then efficiently support, its manifold components and personnel. The pre-identification of outside resources, along with the development of a comprehensive and logic-driven logistics plan for mobilizing and demobilizing them, should be a priority during the pre-planning activities detailed below in Section 6.0.

- <u>Risk from Spills From "Outside" Sources (Shipping and Pipelines):</u> There are 18 oil/gas storage tanks located at 5 locations on the island, with a combined total storage capacity of 163,000 gallons (of gasoline, diesel, and heating fuel). The largest tank on the island is 20,000 gallons; the largest combined total at any of the 5 locations is the 57,400 gallons stored in 8 tanks at the Mott Island facility. In and of themselves, these oil storage facilities have the potential to cause significant environmental impact as the source of a release (all the more testament to the significance of the NPS's first response program). However, the oil storage facilities located on the island do not represent the only risk at hand, or even the most significant risk. Spills from "outside sources", including bulk oil tankers, cargo ships, and other marine traffic and nearby pipelines all have the potential to impact the island. A particular risk resides in non-tank vessel traffic (ore carriers and other bulk cargo ships), which, over the last ten years have caused some of the nation's most difficult spills (refer to footnote 2 above). This issue is compounded by the fact that these bulk carriers are not required under OPA'90 to have constant access to qualified OSROs, meaning that in the event of a major incident they may not be as prepared to bring together a response team quickly (as opposed to bulk oil tankers that are required by law to maintain this type of readiness in any US waters in which they transit). Under these circumstances, the NPS's commitment to First Response readiness from the potential sources is a positive achievement.

- <u>Environmentally-, Economically- and Culturally-Sensitive Areas:</u> The "Inland Sensitivity Atlas – Michigan Upper Peninsula" provides an overview of the wide variety of environmentally/economically/culturally sensitive areas that surround the island. Any oil or similar environmental incident impacting Isle Royale has the potential to significantly impact marine and land wildlife, plants and other valuable natural resources, as well as damage and/or degrade archeological and/or historically important sites. This damage may come in the form of impact from the oil itself (or another substance), or from improper management of response operation assets (e.g., destruction and/or disruption of wildlife as it comes into contact with significantly elevated numbers of humans and machinery on the island). Management of the damage (from both potential sources), is a crucial element of a major spill response effort and should be handled as such by the Spill Management Team, working with scientific experts (who in turn would be referring to various pre-planning documents that detail specific resources and assets at risk, including information regarding certain species habitats, breeding periods, hatching periods, etc.).

- The Requirement for Early and Accurate Spill Trajectory and Notification Data: A primary concern for any first response effort is timely notification of the involved parties that a release has occurred, and up to date information regarding its trajectory. This information is particularly vital for responders at Isle Royale, so that they can effectively deploy the limited amounts of containment boom and other resources to the correct point(s) on the island at the correct time(s), and to make the other decisions necessary to begin combating the spill. MPC feels that a notification plan, including the need for immediate inclusion of NOAA trajectory specialists during a spill event, should be an integral part of the ACP.

- Waterside Operational Stance: For a major release beyond the First Response and into the next Tier of response personnel and equipment (see Table 1 below), most response activities at the island should be undertaken from the water side (both out of necessity due to the remoteness of island shorelines and in order to minimize damage caused by the response operation itself). This would require numerous marine logistics assets coordinated in a complex logistics scheme, and substantial timeframes to “ramp up” to full operational capacity (with on-site housing and foodservice comprising a large part of this effort). Again, MPC feels that both the park’s Response Plan and the ACP need to pre-address these logistic concerns by identifying suitable resources and estimating their mobilization times in a standardized format.

- Harsh Weather Conditions: Isle Royale’s location places it in a meteorological region that includes very harsh weather conditions, including frigid winters and legendary storm activity.

4.0 Discussion Regarding Spill Response Planning (Short and Long Term Vision)

Based on our participation in the site visit and subsequent analysis of the strengths and vulnerabilities of the island, MPC feels that the best way for the stakeholders to continue to protect Isle Royale from the threat of an environmental incident and to build from these recent proactive steps (i.e., the site visit, the NPS First Response initiative, and the development of the Strategic Plan) is to work with the ACP committee to help develop realistic resource databases, set communications standards, and develop a notification/trajectory assessment procedure with the NPS (refer to section 6.0 for additional information in this regard).

If the NPS ultimately decides to be a First Response organization for the island, it must commit to a program of drills, training and exercises to ensure that their personnel are able to achieve the prioritized protection and containment objectives. Ideally, some additional equipment would greatly augment the goal of increasing their mobility and effectiveness (refer to section 5.0 for additional information in this regard).

5.0 MPC Recommendations Regarding First Response Operations

Note: Examples of some of the specific response strategies recommended by MPC for use at the Isle Royale site are detailed in Appendix A.

The NPS is required by OPA '90 to perform exercises in accordance with the PREP guidelines, and has taken the further step of preparing to accomplish First Response services for spills from outside sources in order to prioritize and protect the sensitive environmental and historical assets located on the island. In order to enhance their efforts in this initiative, MPC proposes the following 5 recommendations:

- <u>OSRO Participation in Response Plan Drills and Exercises (PREP Program)</u> The site visit demonstrated that a number of challenging conditions for responders would be faced with when dealing with an oil spill on Lake Superior's waters. Also, the group discussed a number of alternative response technologies during the site visit (including water-herding techniques, specialized booming and anchoring techniques, insitu burning techniques, etc.). In order to increase the effectiveness of first response efforts on the island, as well as test new concepts while familiarizing the island's dedicated OSRO personnel on the specifics of response in the area, MPC suggests that a proactive drill and training program be initiated, with OSRO personnel (the "Support Team" concept detailed below) and NPS personnel working together to implement strategies specified and documented in the Strategic Plan (and other Planning Documents resulting from the site visit). The training program would be structured to follow the current PREP program, with some specialized training on techniques and procedures that are specific to the Isle Royale marine environment. An example of how we envision this program to be constructed and organized is included as appendix B of this report.

- <u>Designation of a Dedicated First Response Operations Support Team (OSRO-supported)</u> MPC proposes the establishment of a pre-identified First Response Support Team, made up of members of the island's dedicated OSRO, that would be able to mobilize to the island in support of the NPS First Response Team in the event of an incident. The team would consist of approximately 10 trained and qualified spill response professionals, including boat operators, boom handlers and response technicians. These personnel would be familiar with the island's Response Plan, and would be immediately mobilized to the island in the event of an incident (see "special note" below). They would fold seamlessly into the field response operations command structure already established upon their arrival (a capability that would be facilitated through active participation in drills and exercises conducted at the island). Additionally, these personnel would be familiar with the Tier II Response Resources Matrix (refer to appendix C), and would be capable of assisting in the mobilization of those services and equipment. The OSRO support team, and the island's First Response team, would be organized under the Incident Command System (ICS), so that continuous command and control of the operation would be ensured throughout all operational phases.

Special Note Concerning Logistics and Mobilization: Perhaps the most critical element of any response operation conducted at the island will be the mobilization times required for personnel and equipment. In the case of the First Response Operations Support Team described above, we would assume that the personnel (and limited amounts of specialized equipment) would mobilize via a private chartered or military/USCG aircraft (departing the Detroit metropolitan area) and landing at the closest appropriate private airport or military/USCG base (i.e., Traverse City or Duluth, or a point closer to the island if applicable). From the initial landing point, the team would then likely travel to the island by means of a seaplane or helicopter (again, privately chartered or a military/USCG asset). Based on ideal conditions, our goal would be to be able to arrive at the island within 4-6 hours of initial call-out.

We would like to stress, however, that during the planning process all operational elements incorporated into the First Response, Tier II and Tier III Response protocols should be examined closely for their logistic requirements and limitations (see table 1 below for a conceptualized version of a island-specific response timetable). Lead times should be studied carefully when identifying resources that qualify for inclusion in the island's Plan (and the ACP), and transportation methods should then be documented in a standardized fashion within those plans. MPC asserts that this concept timeframe is indeed ambitious, but should be considered to form a critical element of the anticipated response success rate, particularly during the early portions of an event when mobilizing enough resources quickly to protect the island is crucial.

Table 1 - Concept of Response Operations Timeframe

Period Reference	**Principle Involved Parties**	**Principle Objectives**	**Time Frame**
NPS First Response	NPS First Response Team	▪ Notifications ▪ Implement ICS ▪ Mobilize NPS Resources ▪ Begin Protection and Containment	0-4 Hours
Tier I Response*	OSRO Support Team NOAA Trajectory Specialist(s)	▪ Protection and Containment ▪ Trajectory Support Arrives	4-6 Hours (on site)

Tier II Response*	Tier II Resources (t/b/d)	▪ Protection and Containment ▪ Recovery Operations ▪ NRDA	12-24 Hours (on site)
Tier III Response*	Tier III Resources (t/b/d)	▪ Recovery Operations ▪ Shoreline Cleaning ▪ Disposal Operations ▪ Decontamination ▪ Demobilization	24+ Hours (on site)

** Please note that in Table 1, our conception of Tier I through III does not correspond directly to the classifications of the same nomenclature detailed in the OPA'90 regulations (i.e., Tier I through III OSRO classifications). Rather, they represent operational phases of a major spill event based on our assessments of "real-world" mobilization schemes for the island.*

- Additional Equipment Procurement Recommendations After reviewing the requirements presented by the environment, and in keeping with the first response objectives identified during the site visit and within the Response Plan, MPC suggests that NPS consider procurement of some additional first response equipment.

  ✓ *Spill Response/Recovery Barges:* Response barges are extremely versatile during spill operations. In addition to being able to hold recovered oil/water mixture, they are also able to support other operations including recovery systems, debris recovery operations, logistic functions, etc., and they can be used to stage equipment on board (i.e., boom, anchoring systems, etc.). They are capable of being towed into position by workboats, and can be anchored in place to free the boats to attend to other duties. MPC recommends that the NPS consider procuring 2 of these vessels, and stationing them on opposite ends of the island to be able to respond quickly – with suitable amounts of equipment stored on board as noted above - during an event (refer to appendix A, figure 5 for examples).

  ✓ *Water Herding Equipment:* These systems can provide a highly mobile and versatile method for diverting/directing oil during first response operations. Consisting of a high-volume, moderate pressure pumps and directional nozzles, they can be quickly mounted – or pre-installed - in any vessel of opportunity and deployed to a site to begin oil-herding activities (or, in some cases they may be ordered as an integral component of a workboat, with a permanently installed nozzle, piping system and pump all located within the hull). In the case of vessels that are dedicated to the island (Beaver, Loon, etc.), it may be beneficial to mount water nozzles and pumps on the boats in advance. These systems can be particularly effective when there isn't time to begin booming operations but responders want to direct oil into a collection/recovery area and/or away from a sensitive area, and free up the use of available booms in other, more critical areas. In addition to using water herding in the traditional sense of directing a water spray laterally across the face of a water surface to divert oil, some work has been performed by the USEPA on the use of horizontal (plunging) water jets to form temporary water curtains that act similar to oil booms. Additional study on this technique may be warranted for use on the island.

- Utilization of Existing Ranger Stations as Spill Command Centers: The NPS maintains 5 Ranger stations on the island (Windigo, Malone Bay, Amygdaloid, Mott Island and Rock Harbor). MPC suggests that these 5 stations should be designated as available staging and command areas for spill response operations, given the fact that they have available existing infrastructure support systems. Plans for how these areas would be utilized in the event of a spill should be developed within the island's Response Plan, and, if it is deemed appropriate, plans for their enhancement in this regard should be considered.

- Installation of Permanent Anchoring Systems to Facilitate Specific Booming Configurations in Deep Water Environments: In certain cases where water depths are substantial (i.e., 100+ feet) but where the need for protective or containment booming strategies has been pre-identified, the NPS may consider the installation of permanent or semi-permanent buoy systems to facilitate the quick installation of booms (Refer to Appendix A, Tactic 7 for an example of a deepwater mooring/buoy system used to establish a pre-established booming configuration in Prince William Sound, AK). In this scenario, buoys attached to deepwater mooring systems are pre-anchored in strategic points and, in the event of a spill, booms are simply and quickly connected to them forming the appropriate configurations. These buoys may be installed permanently or semi-permanently (i.e., removed prior to the winter season), and are moored to the bottom using deadweight anchors (MPC estimates weights of around 1,000lbs to be sufficient, thereby making the assemblies installable using the island's dedicated crane barge). In conducting our research for this portion of our report, MPC consulted with Marine Response Consultants, a marine architecture firm which designs numerous deepwater mooring systems, and who provided us with the following diagram and text regarding an installation for depths and conditions encountered at the island.

MRC-contributed Text:

DEEP WATER BOOMMOORING SYSTEM

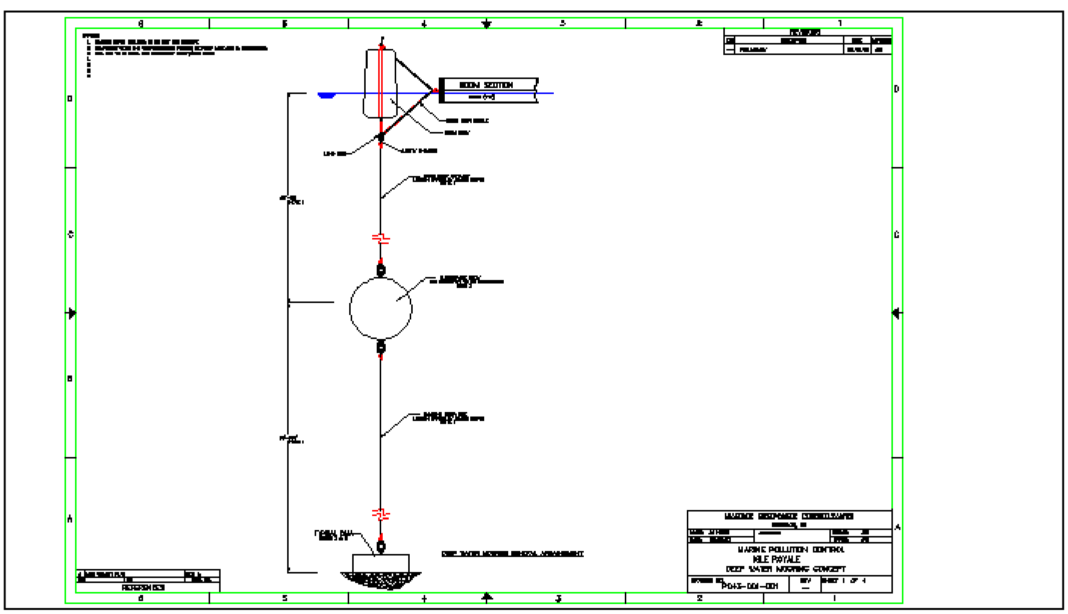
Mooring Boom in deep water requires either a conventional drag embedment anchor with significant amount of scope (minimum six-times water depth) or an approach more in keeping with methodologies used in offshore applications. Both arrangements are subject to current and wind—the conventional system more so than the offshore system.

With a conventional mooring the "watch circle", or the diameter that the buoy watching on the surface can move about, is very large (100's of feet)—and may be come an operational liability and is certainly problematic from the aspect of navigation. The offshore system is more hardware intensive; however, this is offset by a much smaller "watch circle" (10's of feet) with a very predictable location.

The offshore system works by securing a Subsurface Buoy with a large positive buoyancy to a large mooring (DMA, stake pile, etc.) at the desired location. The mooring must be substantial in order to withstand the large uplift forces of the Subsurface Buoy. The Subsurface Buoy must have a large positive buoyancy for it to plumb itself in the water column (even in the presence of currents) with a resultant small watch circle. The Subsurface Buoy becomes the mooring point for the Boom Buoy, which has a watch circle dependent upon the distance the Subsurface Buoy is below the water's surface.

The Subsurface Buoy can be installed and left throughout the year as long as it is sufficiently below the surface to be minimally effected by surface and pack ice. The Subsurface Buoy in such a case would be best served if it was of material resilient to ice and of such that it would survive being pushed to the full depth of its intended service. Installation and recovery of the Boom Buoy can be effected using sweep wires or other like devices and would thus become either seasonal or sacrificial.

Detailed design of such a system would require a that the water depth at the proposed location(s) be accurately known as well as the current profile, worse case wave and wind profiles. This would permit dynamic simulation and the sizing of readily available components to effect an installation.



6.0 MPC Recommendations Regarding Worst Case Scenario Spill Response Operations

A major spill impacting Isle Royale would result in a response operation that could quickly escalate to involve hundreds of response personnel, a fleet of waterborne assets including workboats and barges, thousands of feet of boom, and the recovery of hundreds of thousands of gallons of oil and oil/water mixture requiring temporary storage systems capable of transporting the material to the mainland for disposal. If a major spill occurred in the winter, harsh weather conditions could limit major response operations. With this in mind, MPC again stresses the need for the ACP to be comprehensive and proactive in consideration of this remote and pristine wilderness area and, towards this end, MPC would recommend the following steps to enhance the island's coverage in the event of a major spill release:

- Development of a Site-Specific Database of Contractors for a Worst Case Scenario Spill Impacting Isle Royale: Besides the requirement for a qualified OSRO contractor, a wide variety of other services and goods would be necessary to mount a successful spill response operation to a worst case scenario spill at Isle Royale. In order to best protect the island for future generations, these additional resources should be identified, classified and logged into a database for annual review to establish and maintain the proper level of coverage. This database could be incorporated into all response plans applicable to the region, thereby enhancing protection for other wilderness and remote areas in the Lake Superior ecosystem. A partial list of some of the resources that should be included in the database is included as appendix C of this report, and a method for classifying them within the overall response timeframe matrix is proposed in Table 1 (above).

- Additional Equipment That Would Aid in the Mobilization of a Response Operation for a Worst Case Scenario Situation:

  ✓ *Bird Scaring Devices (Sound Cannons):* Sonic cannons could be helpful to prevent birds from entering areas where there is oil.

  ✓ *Communications Systems:* Response personnel will quickly find that their cellular-based communications systems do not function on the island. Development of a communication system – or plan - suitable for a large spill response operation is recommended.

  ✓ *Cold Weather Response Equipment:* Rudimentary cold weather response equipment including saws and/or trenching machines that could cut access holes through ice to perform assessment, containment and recovery operations is recommended. Also, the procurement and/or prior identification of necessary safety and PPE items associated with cold weather spill response is recommended. It should be noted that any response operation in winter months would be mounted from the mainland rather than the island, and so if such items were procured their storage would have to be arranged accordingly.

Conclusion

It has been a great experience participating in this process with the involved stakeholders and, as we have pointed out, we feel that the group has made substantial progress towards increasing the level of response capability for the island. We strongly support the work that has begun here and will continue our efforts to assist in its implementation, and are open to discussions to that effect at any time. We are including four appendices to this report, which detail additional information we feel is important to the process. Appendix A provides a number of response tactic summaries selected for use at the site. Appendix B is a 3-year table of PREP-based response drills and exercises that we recommend as a starting point for future discussions. Appendix C is a representative table of required services that we feel could be a starting point for the creation of a response database for the island. Finally, Appendix D provides informative case studies, provided by NOAA, featuring four vessel grounding scenarios that reflect upon the response priorities and options that would be applicable at Isle Royale.

If you have any questions regarding this report, please contact:

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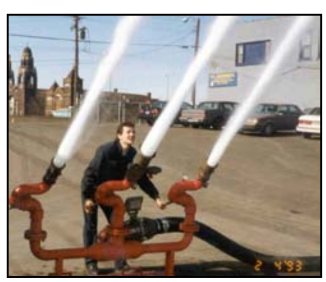
1. Water Herding Techniques

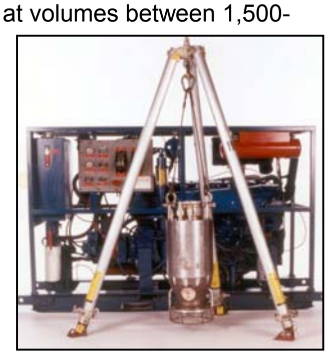
General Description:	Utilization of moderate pressure, moderate flow water stream to direct floating contaminants on a water surface for containment/collection and/or exclusion/protection purposes.
Purpose:	To expedite movement of oil to assist in directing it to suit the responders' purpose (i.e., into containment booms, away from sensitive areas).
Method:	▪ Place pump intake in non-contaminated area (i.e. below the waterline) ▪ Utilize water spray to "direct" the oil on the surface of the water. ▪ Aim "low", do not directly spray the oil or you may cause it to break up and possibly sink. ▪ Aim must be constantly monitored and adjusted to match conditions (do not leave unattended for long periods of time).
Equipment:	▪ Moderate flow, moderate pressure pump (diesel driven preferred) ▪ Adjustable nozzle ▪ Hoses and water intake screen ▪ Work platform (boat, dock, etc.)
Notes:	▪ Extreme caution should be displayed when working with hand-held nozzles.

In this photo, a hydraulic submersible pump and portable fire monitor provide a moderate-pressure, high-volume water spray that can be used for oil herding operations. The fire monitor features 3 independently rotating turrets, which can be adjusted by the operators to provide a wide sweep of operations.

In this photo, the pumping system and fire monitor apparatus have been positioned on the deck of a workboat, allowing responders to access the oil from the waterside and giving them much better latitude to move about (note: here, they are using the spray to wash oil from shoreline fixtures into a containment system for recovery). The water spray produced by this system is delivered at approximately 80-100 psi, and at volumes between 1,500-2,000 gallons per minute.

Here, the principle has been applied on a smaller scale, with technicians using water spray produced from a small "trash" pump and hand-held nozzle apparatus to herd oil within a containment area towards a recovery device (an adhesion drum skimmer). Note the excavator unit positioned on the deck barge, which is used to extract contaminated debris from hard-to-reach areas.





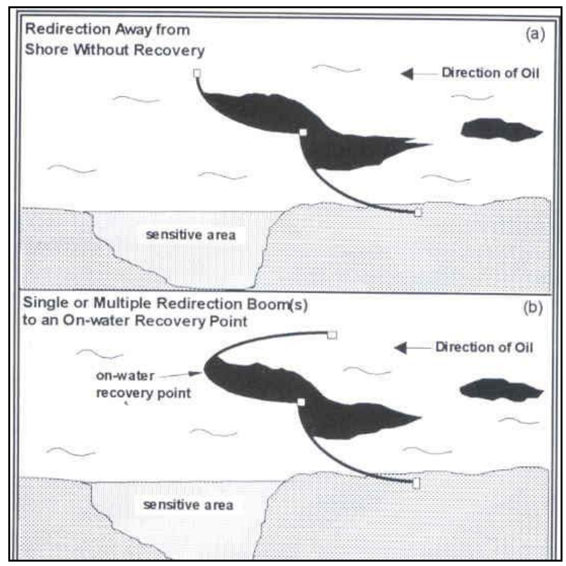
A portable hydraulic submersible pumping system and 3-turret fire monitor, which can be rapidly deployed to a vessel of opportunity or shore-based fixture, to perform water-herding operations. Note: This is the same system mounted on the workboat on the photo above.

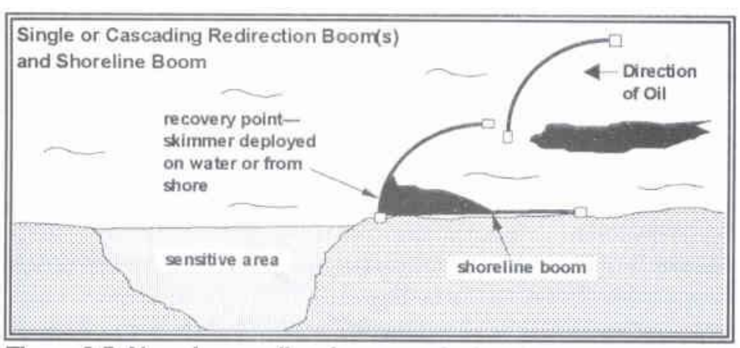
2. Exclusion/Protective Booming Techniques

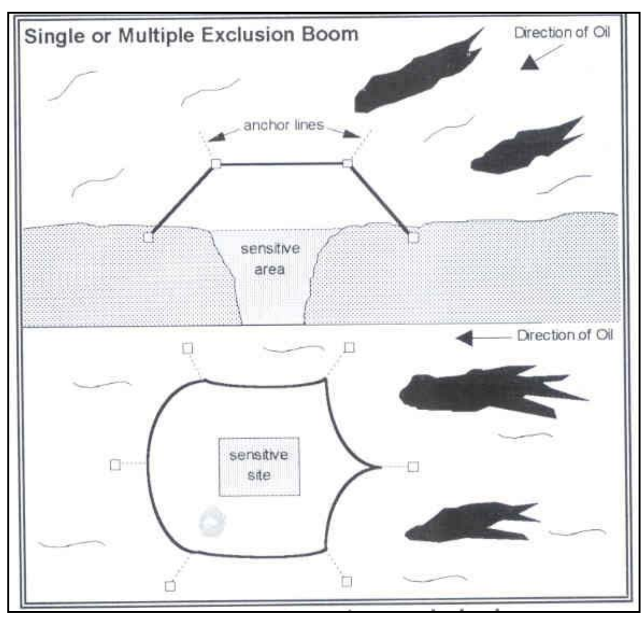
General Description:	Utilization of floating booms to prevent oil from impacting environmentally- or economically sensitive areas.
Purpose:	To establish effective means of preventing oil from entering sensitive areas.
Method:	▪ Establish the direction of flow (trajectory) and identify sensitive areas that may be impacted. ▪ Deploy oil booms in a configuration that prevents oil from entering the exclusion area and/or directs oil away from the area (and into a recovery area).
Equipment:	▪ Appropriate boom and anchoring systems. ▪ Method of deployment (workboats, docks, etc.)
Notes:	▪ Boom must be continuously checked for effectiveness (not simply left in place indefinitely).

<u>Examples of Exclusion/Protective Booming Strategies</u>

Protective booming strategy deployed around a Salmon hatchery during the response operations for the Exxon Valdez incident (Alaska, 1989).





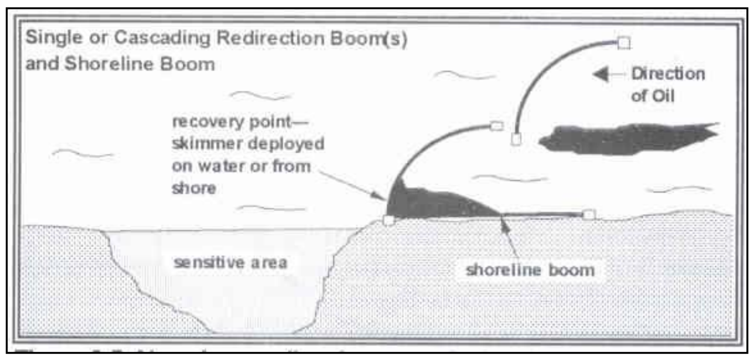


3. Containment/Collection Booming Techniques (Including Cascade & Chevron Techniques)

General Description:	Utilization of floating booms to direct oil to recovery areas.
Purpose:	To establish effective means of containing and collecting oil for recovery operations
Method:	▪ Establish the direction of flow (trajectory) and identify sensitive areas that may be impacted. ▪ Identify point(s) where recovery can be readily accomplished. ▪ Deploy oil booms in a configuration that directs oil to the recovery points and install recovery devices in those points. ▪ Multiple booms can be installed in a "cascade fashion" to direct oil into a containment/collection boom. ▪ Chevron technique directs oil to both sides of a channel of moving water, each leg of the Chevron is essentially a containment/collection boom.
Equipment:	▪ Appropriate boom and anchoring systems. ▪ Method of deployment (workboats, docks, etc.)
Notes:	▪ Tending: Boom must be continuously checked for effectiveness (not simply left in place indefinitely).

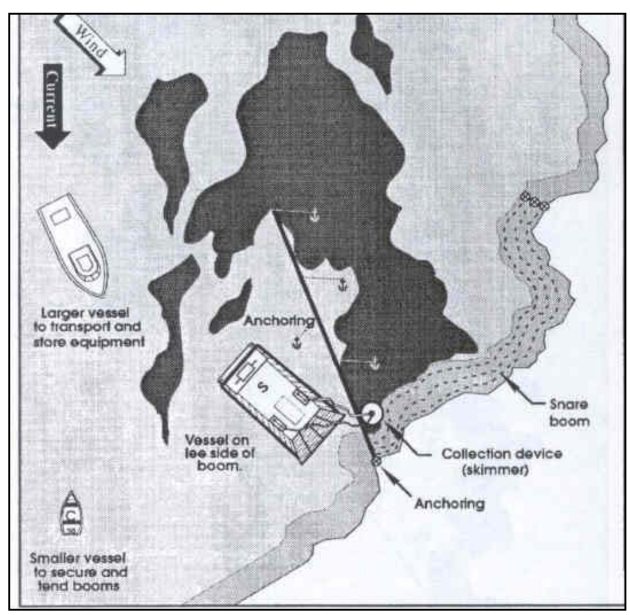
<u>Examples of Containment/Collection Booming Strategies</u>

Containment/collection booms ("fingers") deployed along the shoreline of a river. Note the protective boom installed along the shoreline to prevent unnecessary contamination along that axis (Mississippi River, 2002).



In this cascade configuration, the outer boom is a "diversion" boom directing oil into the containment/collection boom positioned from shore. In this configuration, responders have added a protection boom component as well, which prevents oil from unnecessarily impacting the shoreline in the recovery area.

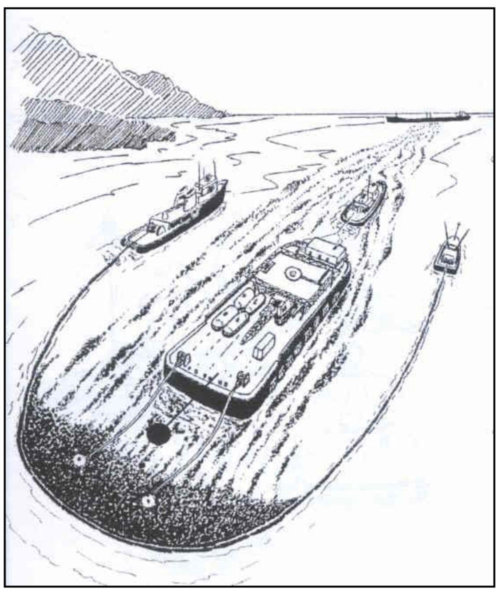
A "Chevron" boom configuration installed on a river. This configuration directs oil to either side of the channel, dependent upon wind and current direction (oil trajectory), forming two recovery points.



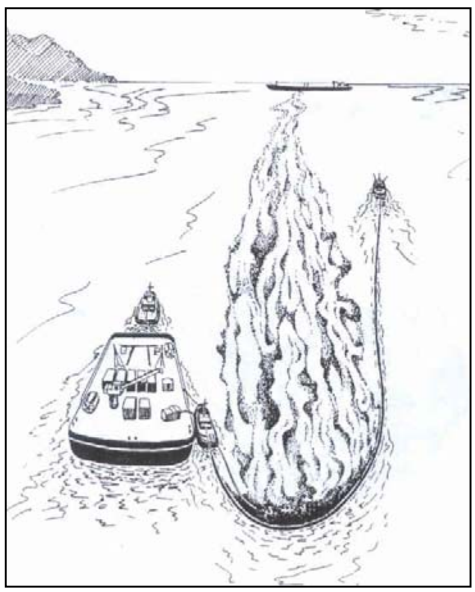
4. Open Water Containment and Recovery Strategies

General Description:	Utilization of floating booms to direct oil to recovery areas; Operations supported totally by floating assets (workboats, barges, etc.).
Purpose:	To establish effective means of containing and collecting oil for recovery operations in open water areas
Method:	▪ Establish the direction of flow (trajectory) and identify sensitive areas that may be impacted. ▪ Deploy workboats and recovery vessels (sized appropriately for the environment) ▪ Deploy oil booms in a configuration that directs oil to the recovery points and install recovery devices in those points. ▪ Multiple booms can be installed in a “cascade fashion” to direct oil into a containment/collection boom.
Equipment:	▪ Appropriate boom and anchoring systems. ▪ Method of deployment (workboats, recovery barges, etc.)
Notes:	▪ Coordination between boat operators is critical element of mission success. ▪ Vessel speed critical; >0.7 knots may result in oil escaping booms via entrainment.

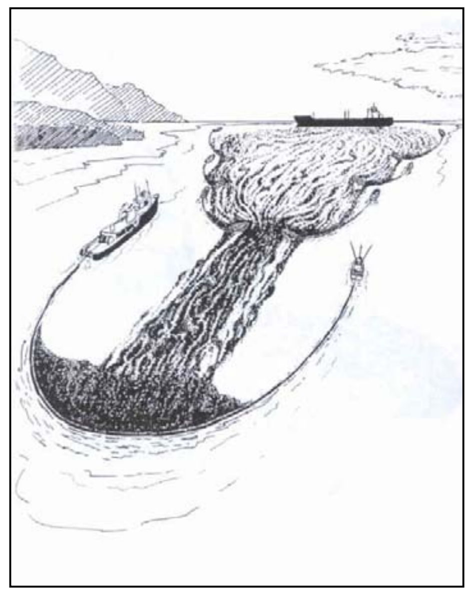
Examples of Open Water Containment and Recovery Strategies



2 boom towing boats and a recovery vessel are utilized to create this “U” Boom containment and recovery configuration.



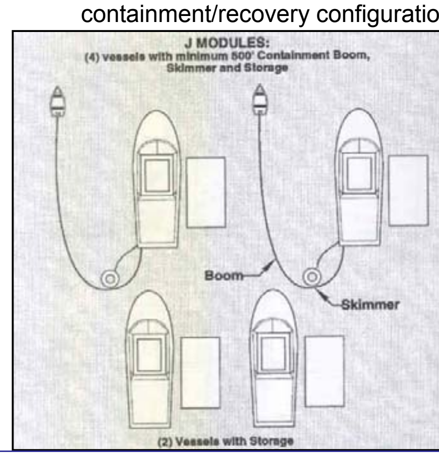
1 boom towing boat and a recovery vessel can create this “J” Boom configuration.



Multiple boats (8+) are required to create this elaborate cascade and containment/recovery configuration.

Left: Open water recovery operations during the response to the Exxon Valdez incident (Alaska, 1989).

Right: Workboats utilized to create J-boom containment configurations for recovery operations.

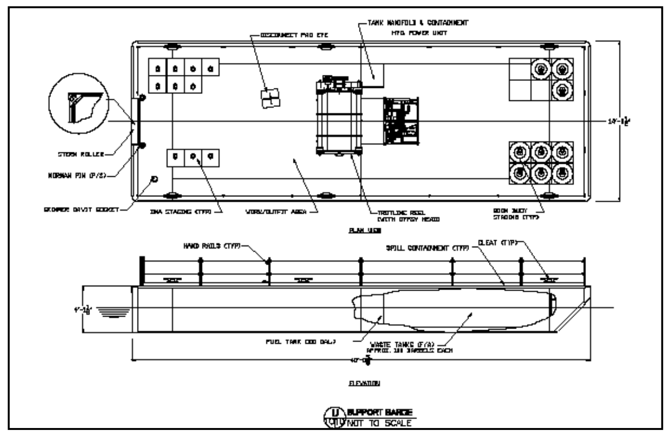


5. Water Side Response Operations (Response Vessels)

General Description:	Utilization of boats and floating assets (platforms, barges, etc,) to support spill response operations to minimize shoreline impact.
Purpose:	To establish effective means of containing and collecting oil for recovery operations via waterside operations in order to prevent damaging shorelines
Method:	▪ Support all operations via boats and floating assets. ▪ Minimize routes for people and equipment to embark and disembark from vessels ▪ Employ shallow water workboats and barges
Equipment:	▪ Workboats, barges and tugs ▪ Boom deployment boats and jonboats.
Notes:	▪ Requirement to work from water side only impairs mobility ▪ Health & Safety oversight critical to ensure mission success

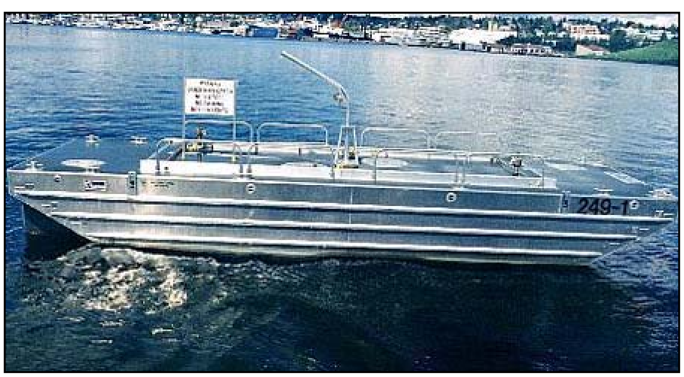
Examples of Water Side Response Operations

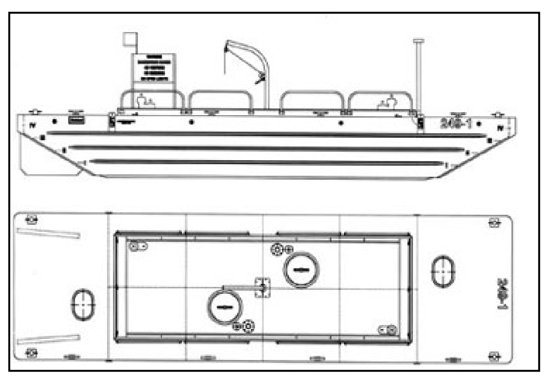
When responding to oiled shorelines in remote locations, waterside logistics become a vital and integral component of the response. By moving the operation into place via water logistics, unnecessary damage to the shoreline is minimized (Exxon Valdez response, Alaska, 1989)



Above: This 40' response barge is specially outfitted with a "Trotline" boom anchoring system, but also can support recovery equipment and can hold recovered oil and water.

Below: A smaller response barge outfitted to hold recovered oil.



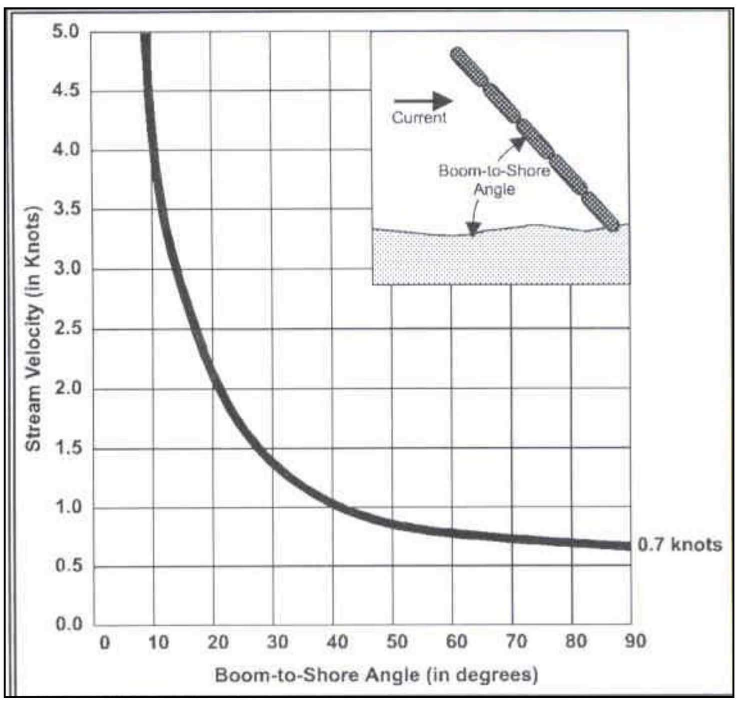


Aluminum Response Barge (unpowered)			
Length:	40' (12.19m)	Capacity (2 tanks):	249 bbl (
Beam (molded):	11'8" (3.6m)	Plates:	5/16"
Depth:	4'10" (1.47m)	Tracking Skegs:	¼"
Stacked (2):	10'11" (3.33m)	Accessories:	Lights, Hatches, Valves, Davit Arm, Signage

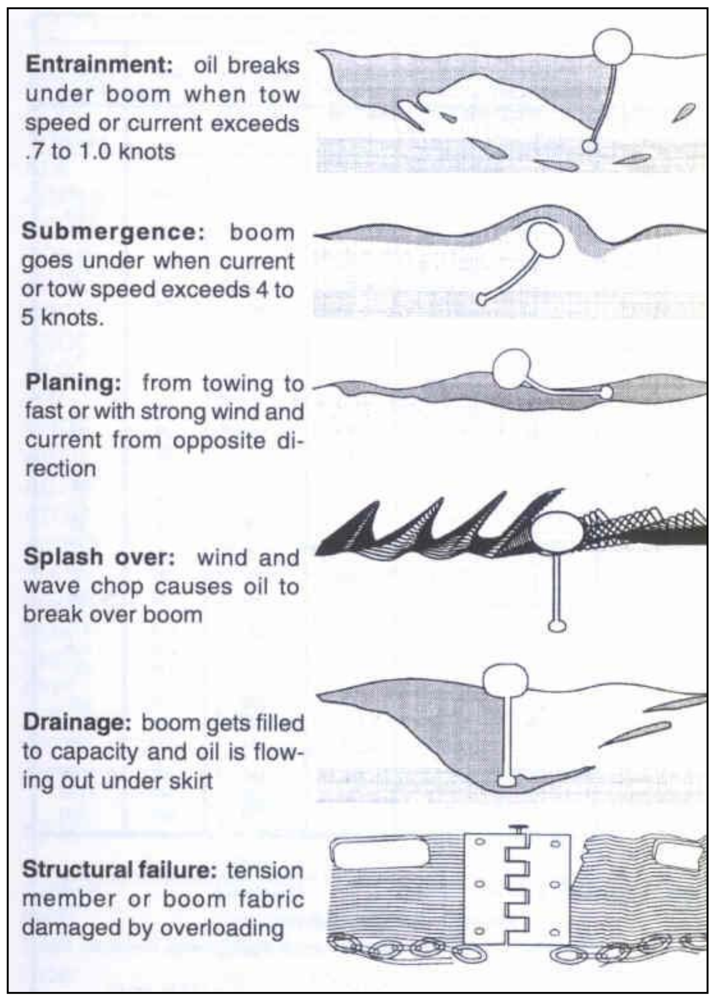
6. Causes for Boom Failure and Boom Encounter Angle Compensation Tables

General Description:	Conventional booms will fail to contain oil in high currents, and can otherwise fail during certain conditions.
Purpose:	Response personnel should know who boom failure occurs to avoid deploying boom in a manner that is likely to have a negative result.
Method:	▪ Entrainment may occur when currents on booms exceed ~0.7 knots. ▪ Splashover can occur in heavy waves/wind. ▪ Submergence can occur during extreme currents (>~4/5 knots). ▪ Overfill (Drainage) can occur when recovery rates do not meet or exceed the rate that oil is collecting in a containment boom. ▪ Physical failure can occur during excessive weather conditions.
Equipment:	▪ Appropriate boom and anchoring systems.
Notes:	▪ Tending: Boom must be continuously checked for effectiveness (not simply left in place indefinitely). ▪ Use the encounter angle graph below when setting boom in currents.

Boom Failures and Encounter Angle Compensation Chart

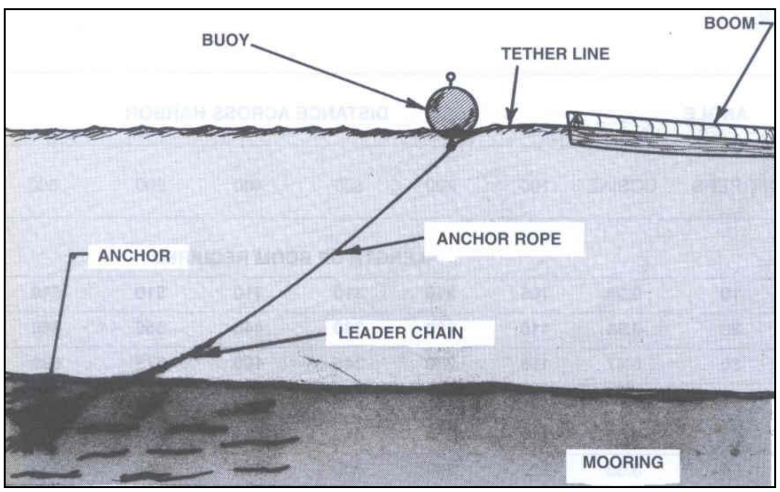


To counteract the effect of current on a containment boom and prevent entrainment of oil below the skirt, responders deploy boom at angles against the current. This graph demonstrates the appropriate angle for currents up to 5 knots. Of course, when deploying boom at an angle, the exposed profile of the boom is reduced considerably, and so more boom is required to attain the proper coverage across the open "mouth" of the boom (when deploying boom from shore).

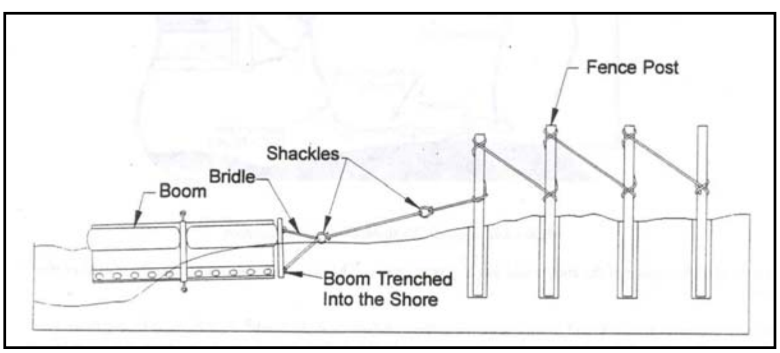


7. Boom Anchoring Techniques (Water and Shore Anchoring)

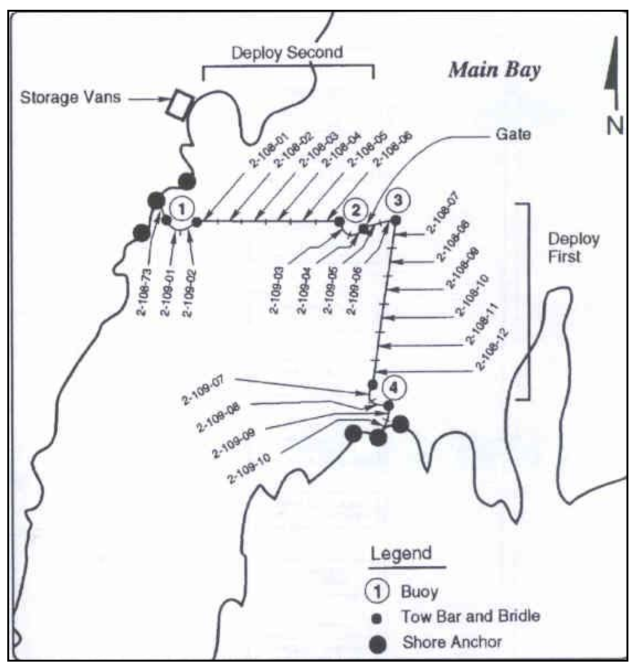
General Description:	Utilization of boat anchoring techniques to anchor boom on water side and use of shore anchoring equipment to affect shore connections.
Purpose:	To establish effective means to hold booms in position.
Method:	Water Side: ▪ Use standard boat anchor equipment and techniques to moor booms in place on the waterside. Shore Side: ▪ Use posts, series of posts (as per diagram) or available connection points to attach booms to shore. ▪ Bulkhead riser systems allow for quick connection to permanently installed beams.
Equipment:	▪ During waterside operations, assessment of bottom type (mud, sand, rock) will dictate the type of anchor that will hold. ▪ Boom tending vessels require robust propulsion systems to hold boom against currents ▪ In areas where anchoring is difficult it may be prudent to consider installing permanent mooring points (i.e., buoys)
Notes:	▪ In high-current areas, multiple anchors may be required to hold booms in place.



The anchor rope should be set at 5-7 times the water depth at the deployment location. If booms will be left out overnight, the marker buoy should be replaced with a lighted unit. In high current, high wind areas, multiple anchoring systems may be required to hold booms in place.



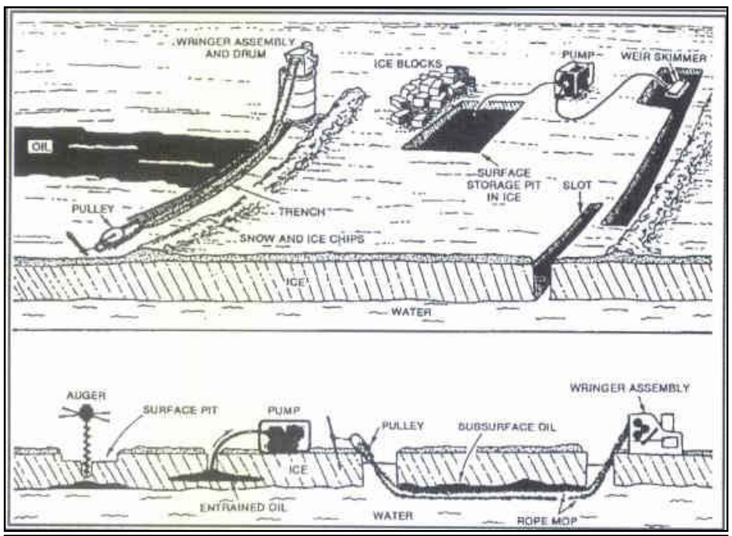
Shoreline anchoring system capable of sustaining high-current boom deployment. Note that the boom is trenched into the shoreline to provide a good seal and create an effective recovery point (trenching method can be replaced with sandbagging).



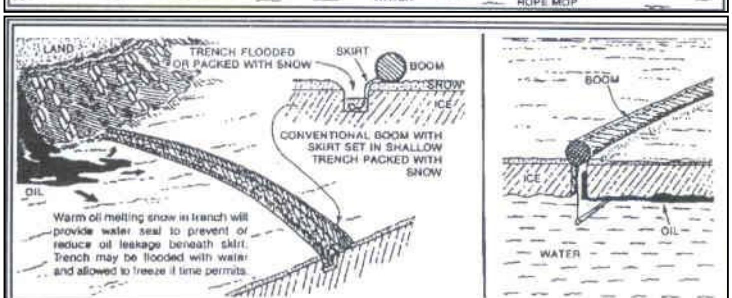
4 permanently installed buoys form the anchoring system for this chevron boom configuration installed in Alaska.

8. Cold Weather (Ice) Response Techniques

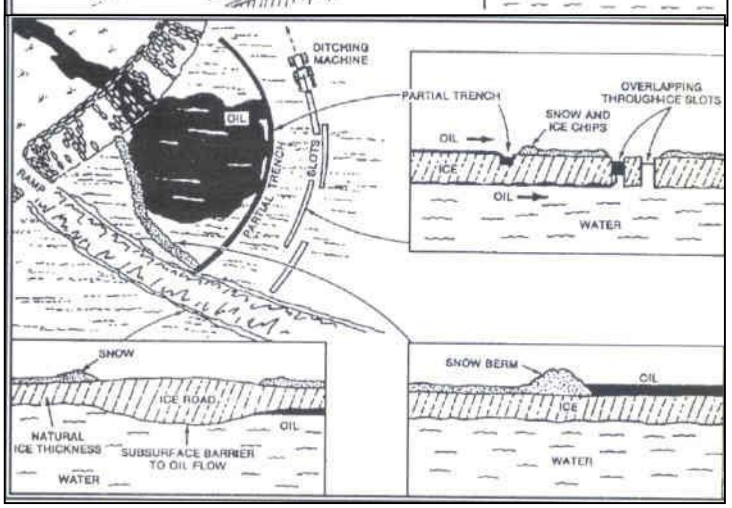
General Description:	Utilization of trenching, drilling and other methods to contain and recovery oil from the surface and underneath ice.
Purpose:	To establish effective means to contain and recover oil during winter months.
Method:	▪ Various methods are detailed below – they all essentially rely on creating trenches and/or other openings to access oil under ice, or to contain oil flowing over the surface of ice.
Equipment:	▪ Chainsaws, powered drills and mechanical trenching machines. ▪ Rope-mop and/or other types of recovery devices. ▪ Containment booms and/or berming techniques
Notes:	▪ Extreme caution must be exercised whenever venturing onto ice patches. ▪ In certain cases, it may be most prudent to establish an effective containment system and wait for spring thaw to attempt recovery.



Ice trench with vacuum recovery skimmer installed.



Ice trench with rope-mop recovery skimmer installed.

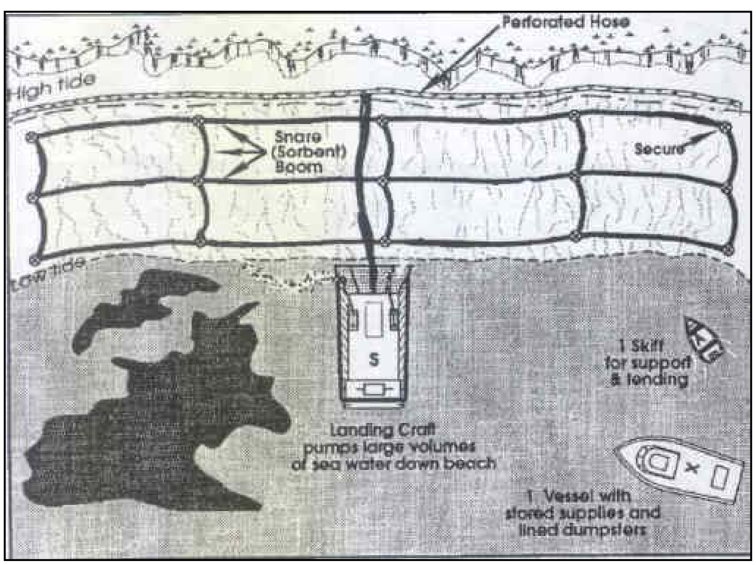


9. Shoreline Washing Techniques

General Description:	Utilizing various pressure/spray systems, responders wash oil from shoreline surfaces into containment areas where oil is recovered.
Purpose:	To remove oil from shoreline surfaces without unnecessarily driving the oil deeper into the sediments and/or “sterilizing” the surfaces due to temperature of water spray.
Method:	▪ Several methods are depicted below. Each relies on washing oil off shoreline surfaces into containment areas established by booms. ▪ A particular method is chosen after carefully assessing the surfaces to be cleaned. Some methods may cause undue harm to the shoreline (i.e., a high-pressure wash should not be used on a sandy beach as it will only drive the oil into the sand. An environmental specialist should be consulted prior to using any method.
Equipment:	▪ Pumps with hand-held nozzles or perforated tubes to provide deluge effect. ▪ Containment booms. ▪ Recovery devices (skimmers, vacuums, absorbents, etc.)
Notes:	▪ Again, special care must be taken to select the pressure, flow, and temperature of the was water prior to undertaking these operations.

Technique	Pressure Range		Temperature Range (°C)
	psi	bars	
(2) flooding ("*deluge*")	< 20	< 1.5	ambient water
(3) low-pressure, cold wash	< 50	< 3	ambient water
(4) low-pressure, warm/hot wash	< 50	< 3	30 - 100
(5) high-pressure, cold wash	50-1000	4 - 70	ambient water
(5) "*pressure washing*"	> 1000	> 70	ambient water
(6) high-pressure, warm/hot wash	50-1000	4 - 70	30 - 100
(7) steam cleaning	50-1000	4 - 70	200
(8) sandblasting	~ 50	~ 4	n/a

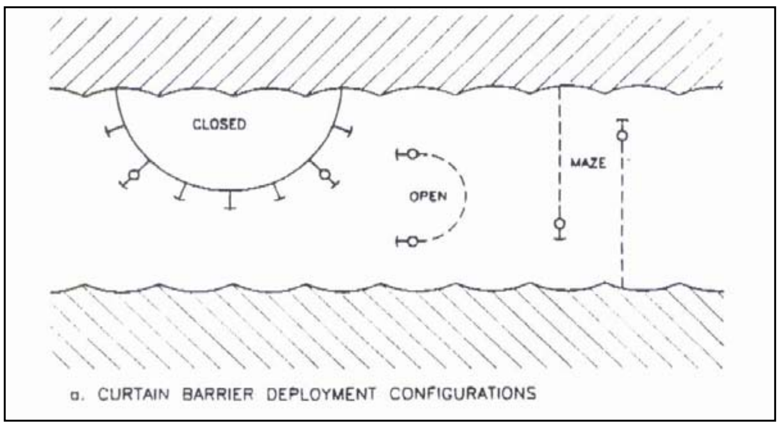
Shoreline washing operations during the response operation for the Exxon Valdez (Alaska, 1989).



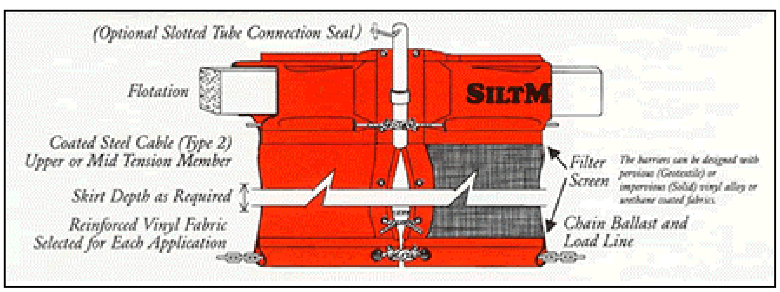
Workboats and barges lend vital logistic support to the shoreline cleaning operations, providing storage capacity for recovered oil and debris, and working platforms for recovery systems and pumping apparatus.

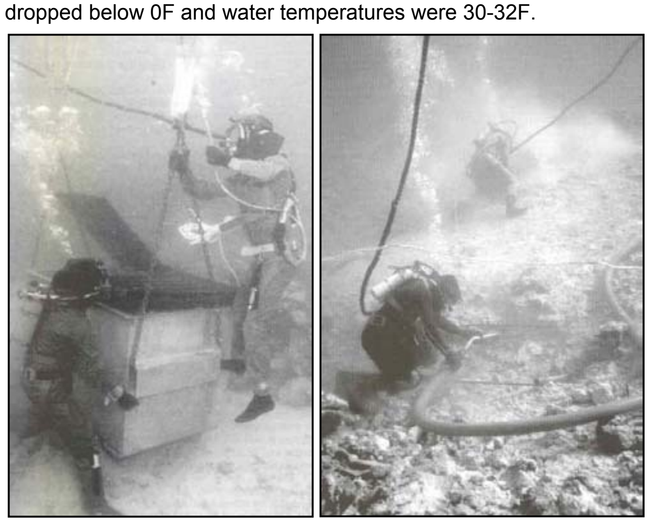
10. Containment and Recovery of Submerged Oil (Group V Oil)

General Description:	Utilization of trenching methods and/or barrier booms to contain submerged oil; Utilization of pumps, clam buckets and manual methods of recovering submerged oil.
Purpose:	To establish effective containment and recovery of Group V Oils that sink in water, or other oils that have combined with sediments or have weathered, causing them to sink.
Method:	▪ Oil is contained through installation of long-skirted barrier booms or by trenching strategies (see diagrams below) ▪ Recovery is accomplished through diver-assisted pumping (or vacuuming), by using cranes equipped with clamshell buckets, or manually by divers using absorbents.
Equipment:	▪ Pumps or vacuums capable of recovering oil. ▪ Cranes with clamshell buckets. ▪ Dive teams.
Notes:	▪ Most pumping methods will recover a great deal of water with the oil; large amounts of temporary storage may be required.

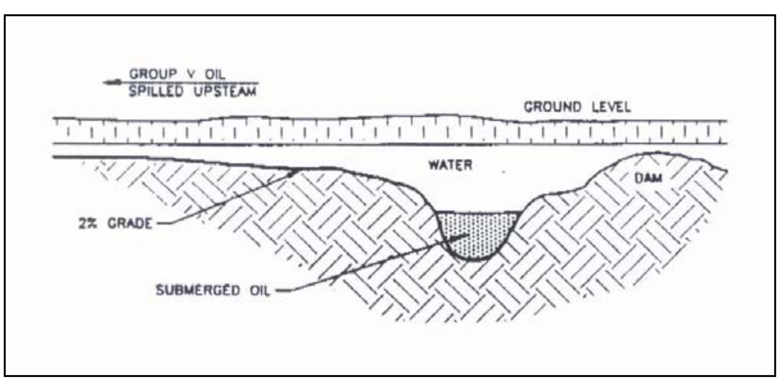


Above: During this response to a Group V oil spill (Coal Tar), responders used two techniques to recover the oil: diver-assisted pumping operations and environmental-clamshell dredging (pictured). All operations were conducted at a depth of 25-35 feet, and in harsh winter conditions where surface temperatures dropped below 0F and water temperatures were 30-32F.





Above: Cross-section of a dredging barrier that could be deployed to contain submerged oil. The skirt depth can extend 30+ feet below the floatation cells at the surface. Below: Cross-section of a trenching containment system utilized to prevent submerged oil from migrating and provide a recovery point.



Two methods of performing underwater recovery operations. On the left, divers load contaminated soils and debris into a lift basket. On the right, divers utilize a purpose-built pumping system to recover the contaminant from the bottom. In this case, the product being recovered is an antifoulant agent, but the principles being applied will also work with heavy oils (Great Barrier Reef, Australia, 2000).

Appendix B - Proposed PREP Training Schedule for Isle Royale National Park

Isle Royale participates in the PREP guidelines program for OPA'90 compliance. MPC is the park's designated OSRO responder and, as such, can assist in the design, facilitation and performance of the exercises to assist the NPS personnel in attaining capabilities to meet the goal of expanding First Response capacity

The primary objectives are to utilize the exercise program to provide hands-on training for the NPS personnel in the specific capabilities of performing boom anchoring techniques, effective booming configurations, boom handling techniques, storage and maintenance procedures, water herding techniques, deployment and use of recovery equipment and other response methodologies specific to the Isle Royale marine environment.

The exercise program would also serve to certify the NPS workers in the required OSHA 1910.120 HAZWOPER Training (40 hour initial and 8 hour annual updates).

. Here is a suggested table of annual drills as proposed by MPC:

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
YEAR 1	QIN			QIN		TTX EDX	QIN			QIN UNA		
YEAR 2		QIN			QIN		TTX EDX	QIN UNA			QIN	
YEAR 3			QIN			QIN	TTX	EDX UNA	QIN		TTX	QIN

Notes:

QIN Qualified Individual Notification Drill
TTX Spill Management Team Table -Top Exercise
EDX Equipment Deployment Exercise
UNA Unannounced Drill

Year-One Drill And Exercise Objectives – General Descriptions*		
Description	**Operational Objectives**	**Target Core Components**
QI Notification	1. Contact made with QI. 2. Form completed. 3. Drill evaluated by SMT.	▪ Notifications ▪ Documentation ▪ 1 Unannounced Drill
SMT TTX	1. Design Concept: Assume park tank leaks 200 gallons of diesel. 2. Mobilize first response team and contain and recover oil. 3. ICS for this stage will be established. 4. Final product will be production of an IAP that addresses the situation. 5. Form completed. 6. Drill evaluated by SMT.	▪ Notifications ▪ Staff Mobilization ▪ Management System ▪ Discharge Control ▪ Assessment ▪ Containment ▪ Internal Communications ▪ External Communications ▪ Transportation ▪ Documentation
Equipment Deployment Exercise	1. Deploy 1,000' of containment boom in same area as table-top drill spill scenario depicts. Deploy in containment and protective strategies 2. Simulate recovery operations. 3. Site safety plan implemented. 4. Documentation Form completed. 5. Drill evaluated by SMT.	▪ Staff Mobilization ▪ Discharge Control ▪ Assessment ▪ Containment (simulated) ▪ Recovery (simulated) ▪ Internal Communications ▪ Transportation ▪ Personnel Support ▪ Equipment Maintenance ▪ Documentation

*Note: During drill Year 1, there should also be a 40-Hour Oil Spill Response Training course coordinated with the drills and exercises schedule.

Year-Two Drill And Exercise Objectives — General Descriptions		
Description	**Operational Objectives**	**Target Core Components**
QI Notification	1. Contact made with QI. 2. Form completed. 3. Drill evaluated by SMT.	▪ Notifications ▪ Documentation
SMT TTX	1. Assume an oil barge has grounded on the north shore of the island. The barge has already leaked 2,000 gallons of oil, which has impacted the shoreline. 2. Complete ICS team on site (facility where TTE will be conducted). 3. Final product will be production of related ICS forms that simulate the situation at 2400 hours from start point (including IAP, Procurement Forms, Safety forms, and PR forms — assume press conference will be held). 4. Documentation form completed. 5. Drill evaluated by SMT.	▪ Notifications ▪ Staff Mobilization ▪ Management System ▪ Discharge Control ▪ Assessment ▪ Containment ▪ Recovery ▪ Protection ▪ Disposal ▪ Communications ▪ Transportation ▪ Personnel Support ▪ Equipment Maintenance and Support ▪ Procurement ▪ Documentation ▪ 1 Unannounced Drill
Equipment Deployment Exercise	1. 1,000' of boom deployed on north side of the island (remote location, away from the island's storage tanks. Booms deployed in containment and protective strategies. 2. Skimmer is operated at Recovery Point. 3. Site safety plan implemented. 4. Documentation Form completed. 5. Drill evaluated by SMT.	▪ Staff Mobilization ▪ Discharge Control ▪ Assessment ▪ Containment ▪ Recovery ▪ Protective Booming ▪ Internal Communications ▪ Transportation ▪ Personnel Support ▪ Equipment Maintenance ▪ Documentation

Year-Three Drill And Exercise Objectives		
Description	**Operational Objectives**	**Target Core Components**
QI Notification	1. Contact made with QI. 2. Form completed. 3. Drill evaluated by SMT.	▪ Notifications ▪ Documentation
Equipment Deployment Exercise	1. Pipeline spill causes impact to western shoreline, 1,000' of boom deployed in protective configuration to protect environmentally sensitive area. 2. Site safety plan implemented. 3. Documentation Form completed. 4. Drill evaluated by SMT.	▪ Staff Mobilization ▪ Discharge Control ▪ Assessment ▪ Containment (simulated) ▪ Recovery (simulated) ▪ Internal Communications ▪ Transportation ▪ Personnel Support ▪ Equipment Maintenance ▪ Documentation ▪ 1 Unnanounced Drill
SMT TTX	1. A 20,000 gallon diesel tank ruptures on the island in winter, weather conditions permit a limited crew to be mobilized to the site to perform assessment and containment (96 hour operational window). 2. Mobilize identified parties to site (facility where TTE will be performed). 3. ICS for this stage will be established. 4. Final product will be production of an IAP that addresses next operational period, including spring response considerations. 5. Documentation form completed. 6. Drill evaluated by SMT.	▪ Notifications ▪ Staff Mobilization ▪ Management System ▪ Discharge Control ▪ Assessment ▪ Protection ▪ Internal Communications ▪ External Communications ▪ Documentation

Appendix C - Isle Royale Oil Spill Response Plan - Subcontracted Resources Matrix						
Oil Spill Removal Organizations (OSROS)						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Marine Pollution Control	8631 West Jefferson Detroit, MI 48209	313-849-2333	313-849-1623	Mike Popa	HAZMAT Technicians, Recovery and Containment System	8-24 hours
Temporary Storage Devices						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Salvage Services						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Marine Response Alliance		313-849-2333		Mike Popa - Region 9		
Emergency Lightering Services						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Marine Pollution Control	8631 West Jefferson Detroit, MI 48209	313-849-2333	313-849-1623	Mike Popa	HAZMAT Technicians, Recovery and Containment System	8-24 hours
Marine Response Alliance		313-849-2333		Mike Popa - Region 9		
Emergency Towing Services						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Marine Response Alliance						
Emergency Marine FireFighting Services						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Marine Response Alliance		313-849-2333		Mike Popa - Region 9		
Portable Barges and Marine Services						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Absorbent Supplies						

Subcontractor	Address	Phone	Fax	Contact Name	Resources	Est. Time to Site
Heavy Equipment (Excavators, Backhoes, Bobcats, etc.)						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Rental Equipment (Light Plants, Generators, Air-Compressors, etc.)						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Fleet Services (Roll-Off Trailers (HAZMAT-licensed), Gravel Trains, Flatbed Services, Personnel Vans, etc.)						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Office Trailers						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Utility Services (Phone and Power Line Drops, etc.)						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Analytical Services						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Disposal Facilities						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Air Transport and Helicopter Overflight Services						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**
Personnel Lodging						
Subcontractor	**Address**	**Phone**	**Fax**	**Contact Name**	**Resources**	**Est. Time to Site**

Hardware and Related Merchandise						
Subcontractor	Address	Phone	Fax	Contact Name	Resources	Est. Time to Site
Catering						
Subcontractor	Address	Phone	Fax	Contact Name	Resources	Est. Time to Site
Medical Facilities and Services						
Subcontractor	Address	Phone	Fax	Contact Name	Resources	Est. Time to Site
Port-A-Johns and Related Sanitary Services						
Subcontractor	Address	Phone	Fax	Contact Name	Resources	Est. Time to Site
Fuel Supply Services						
Subcontractor	Address	Phone	Fax	Contact Name	Resources	Est. Time to Site
Wildlife Rescue and Rehabilitation						
Subcontractor	Address	Phone	Fax	Contact Name	Resources	Est. Time to Site

Name of Spill: M/V *Firat*
NOAA SSC: Bradford L. Benggio
USCG District: 7
Date of Spill: 11/15/94
Location of Spill: Fort Lauderdale, Florida
Latitude: 26°06.6' N
Longitude: 80°05.5' W
Spilled Material: #2 fuel oil, IFO
Spilled Material Type: 2
Amount: 44,000 gallons diesel, 170,000 gallons IFO
Source of Spill: motor vessel
Resources at Risk: Habitats: mangroves and mangrove mitigation areas
Fish: fisheries
Birds: wading and diving birds
Marine mammals: manatees
Reptiles: sea turtles
Recreation: tourist beaches, state park
Dispersants: N
Bioremediation: N
In-Situ Burning: N
Other Special Interest(s): none
Shoreline Type(s) Impacted: none
Keywords: potential spill
Incident Summary:

On November 15, 1994, the USCG received notification of a grounded 506-foot Turkish freighter off Fort Lauderdale, Florida. The vessel had been blown off its anchorage by high winds and seas associated with Tropical Storm Gordon and ran aground 88 yards off the beach, one mile north of the Port Everglades entrance. The ship was carrying more than 44,000 gallons of diesel fuel, 170,000 gallons of intermediate fuel oil (IFO), and a cargo of 2,600 tons of steel.

Initially, there seemed to be little threat of pollution and the RP began planning salvage operations. Protection strategies were addressed in accordance with the Area Plan, trajectory analysis forecasts, and resources-at-risk information.

On November 18, three days after the grounding, some minor oil leakage was observed. An investigation determined that the vessel had sustained some hull damage during the grounding and concern about a potential large release increased. By November 19, the command post was operating 24 hours a day. Protection strategies and priorities were developed and implemented while salvage operations were conducted.

The salvors determined that approximately one-half of the steel cargo would have to be offloaded to refloat the vessel at high tide, The offloading was a slow process because the cargo was in the form of bulk steel rebar that was not easy to handle in the large swells nearshore. Salvors calculated that each ton of cargo offloaded would be the equivalent of about one inch in the depth of the water; making the accuracy of tide predictions critical.

Determining actual tide levels on-scene was enhanced by the installation of a tide staff in Port Everglades.

Offloading the fuel and the required amount of steel cargo was completed on November 26.

The ship was successfully refloated during the afternoon high tide. The vessel was towed to 53 USCG District 7, an anchorage for a complete hull inspection and damage survey. Vessels with oil snare, boom, and skimmers were in place in the event of a release during the salvage operations.

No leakage occurred and the vessel was towed into Port Everglades.

Behavior of Spilled Material:

A few minor spills occurred during this incident due to hairline fractures in the ship's hull releasing small quantities of oil in rough seas. This oil created a sheen that extended a few hundred yards downcurrent of the ship and then dissipated. No shoreline or other resource oiling was observed.

Countermeasures and Mitigation:

No pollution impacts were reported from this incident. Protective measures included booming at the vessel and pre-staging response equipment in case of further discharges during the lightering and refloating operations. Oil snare was tied to lines and deployed along the beach as a protective measure in the event of a release.

Other Special Interest Issues:

There was reportedly extensive damage to the nearshore coral reef as a result of the ship's grounding and continual movement in the surf zone.

NOAA Activities:

NOAA was notified of this incident on November 15, 1994, by the USCG. The SSC provided the FOSC with on-scene scientific support from November 19 through 26. The SSC provided a trajectory analysis forecast, resources-at-risk report, tides and weather information, and helped develop appropriate protection and contingency strategies. The SSC coordinated with NOAA's Tides Analysis Branch and the National Ocean Service Atlantic Operations Center to have a NOAA Tides Officefield party install a tide staff at the response location so that actual tide levels could be monitored. NOAA's Hazardous Materials Response and Assessment Division (HAZMAT) used these actual tidal observations to predict tide heights accurately during the salvage operations. The accuracy of tidal information was crucial to the salvage operations and lightering requirements for refloating the vessel. HAZMAT analyzed the littoral processes and sediment transport near the grounding site and predicted that salvage operations could become more difficult with time due to the formation of a tombolo on the lee side of the ship. This tombolo did form and buried portions of the hull in two to three feet of sand. NOAA supported this response for five days.

Appendix D – Case Study 2
Source: www.noaa.gov

Name of Incident: Freighter *Fortuna Reefer*
NOAA SSC: Bradford L. Benggio
USCG District: 7
Date of Incident: 07/24/97
Location of Incident: Mona Island, Puerto Rico
Latitude: 18°3.3' N
Longitude: 067°52' W
Spilled Material: IFO 180 and marine diesel
Spilled Material Type: 2
Source of Spill: fishing vessel
Resources at Risk: Habitats: living coral reefs, turtle nesting habitat
Birds: shorebirds
Reptiles: hawksbill sea turtles
Management Areas: Mona Island Natural Reserve, Federally designated critical turtle nesting habitats
Dispersants: N
Bioremediation: N
In-Situ Burning: N
Other Special Interest(s): Grounding occurred nearshore on coral that is part of the Mona Island Commonwealth of Puerto Rico Natural Reserve.
Shoreline Type(s) Impacted: pockets of narrow porous coralline sand, vertical rocky terrain, natural beach, rock outcrops
Keywords: boom, Corexit 9527, Corexit 9500, endangered species, rare species, salvage, skimmers, sorbents, SUPSALV, threatened species,

Incident Summary:

On July 24, 1997, the USCG MSO in San Juan, Puerto Rico was notified that the freighter *Fortuna Reefer* had run aground just 300 yards southeast of Mona Island. The island is a Commonwealth of Puerto Rico natural reserve with numerous endangered, threatened, and rare species and federally designated critical habitats.

The vessel had departed Mayaguez, Puerto Rico en route to the western Pacific with no cargo. Fuel onboard consisted of 100,000 gallons of heavy fuel oil, IFO 180, and 33,000 gallons of marine diesel. All fuel was distributed in several double-bottom tanks.

Physical damage to the reef was the only known impact to the environment. While there was no oil released from the ship, the Unified Command prepared contingencies in the event of an unexpected release. Boom, sorbents, skimmers, storage devices, and other response support equipment were prestaged onshore and on a work barge on-scene to rapidly respond to a spill. Representatives from the USCG, NOAA, USFWS, Puerto Rico Department of Natural and Environmental Resources (DNER), and the RP made site visits to Mona Island to assess the threat to natural resources and develop recommendations for protection priorities and strategies. Effective response options were significantly restricted due to;

1. Limited access to the grounding site because of shallow water and coral rock at or near the surface, as well as limited access to the shoreline due to vertical rocky cliffs,

2. Limited ability to stage equipment, supplies, and personnel on-scene because of the remoteness of the location and, USCG District 7 12,

3. Limited ability to boom, contain, and recover oil mechanically due to seas and unpredictable nearshore eddy and rip currents.

The U.S. Navy Superintendent of Salvage (SUPSALV) assisted on-scene and worked closely with a representative from the RP to develop a safe and effective salvage plan. A first attempt to extract the vessel was made on July 29, but failed when tow lines parted.

A second extraction attempt was planned after additional fuel was removed from the vessel. The additional lightering was conducted to reduce risk to the environment during the salvage operations in the event of a spill and to help lighten the vessel for refloating.

Since all the fuel could not be offloaded from the ship, the USCG decided to require that dispersant capability be on-scene. The second extraction attempt was made on July 31 and was successful. Once the vessel was refloated, divers conducted a hull inspection before it was towed to Mayaguez for repair assessments.

Behavior of Spilled Material:

No material was spilled during this incident. The primary concern was for the impacts that would occur to nearshore coral and aquatic resources, as well as to federally designated critical shoreline turtle nesting habitats.

IFO 180 is a heavy fuel oil and would likely weather into persistent tarballs. Because this oil type is a heavy fuel oil, it could incorporate sediment and form mats or rollers on the bottom. It could coat coral and other benthic resources. Recovery of subsurface oil may have been extremely limited or impossible. The marine diesel would be less persistent and would tend to evaporate and disperse fairly quickly, but could be expected to cause localized water column impacts nearshore due to its more soluble toxic fractions.

Trajectory analyses indicated that any spilled product would likely move to the west with prevailing winds and currents. Due to the proximity of the vessel to shore, shoreline impacts would be likely if a release occurred at or near the grounding site. It was predicted that tarball impacts to the Dominican Republic could occur three to four days following a spill.

Countermeasures and Mitigation:

Boom was deployed forward of the vessel to capture oil in the event of a small release. Additional boom, sorbents, and skimming equipment was on standby. Some equipment was pre-positioned for a more rapid response and contingencies were developed for shoreline booming and resource protection prioritization in the event of a spill. The USCG ordered the deployment of Corexit 9527 on standby to be used should a spill take place during salvage operations.

Other Special Interest Issues:

The NOAA SSC was asked to help evaluate alternative countermeasures for a spill of the oil onboard. Response alternatives evaluated included use of dispersants, in-situ burning, bioremediation, and chemical shoreline cleaning agents. Due to sea states in the area at risk, effective mechanical removal or in-situ burning would not be feasible with present techniques and equipment.

Preliminary dispersant testing and gas chromatography-mass spectrometry (GC/MS) analyses were conducted by NOAA for the IFO 180, a blend of a diesel fuel and a heavy fuel oil. The cargo oil was tested using Corexit 9527 and Corexit 9500. Both chemical formulations demonstrated observable dispersion, but the oil was not highly or easily dispersed. Analysis indicated that under actual conditions, multiple applications and ample surface mixing may be required for dispersant application to be effective. This test was essentially a screening method modified from the swirling flask test and scored visually as either positive or negative relative to two controls, the test oil alone and South Louisiana crude. For this IFO 180, the residual fuel oil fraction was essentially a reduced crude. It was expected that the oil would weather, if spilled, much like a weathered mid- to heavy-crude oil.

Although dispersant effectiveness was estimated to be somewhat limited for this oil, the identification of dispersants as a response method was made by the OSC to minimize the risk of serious environmental damage.

A plan was developed to implement dispersant application in accordance with guidelines from all interested parties. The USCG contracted a DC-4 aircraft with dispersant application capability to arrive at Rafael Hernandez Airfield at the USCG Air Station, Borinquen, Puerto Rico. The aircraft was scheduled to arrive on July 31, 1997, with 1,500 gallons of Corexit 9527 onboard. An additional 5,000 gallons of Corexit 9527 were scheduled to arrive by air cargo. The additional Corexit was a precaution in the event a significant amount of oil spilled during vessel salvage and extraction operations.
On the morning of July 31, 1997, the Caribbean Regional Response Team (CRRT) was activated by telephonic conference to discuss the contingent dispersant plan and determine what distance from shore and coral, the dispersants should be applied to

maximize the environmental benefit. Resources of concern and tradeoff issues were discussed, especially hawksbill turtles and living coral. Also present on-scene were a USFWS representative and the SSC. All CRRT representatives agreed that the gross oil would likely be more harmful to resources of concern than effects caused by adding dispersant. Trajectory, weather, and oil behavior information indicated that dispersing the oil would likely reduce shoreline impacts by removing some portion of the slick into the water column where wind effects would not drive it shoreward. The CRRT therefore approved the use of dispersants in accordance with the Caribbean Dispersant Usage Plan up to the shore with no limitations of water depth or distance from living coral.

Although approval was given to use the dispersant, the plan emphasized that effectiveness would depend in part on adequate mixing energy. Since the mixing energy in the lagoon inside the reef line is significantly reduced, it was recommended that dispersant use in this area be carefully considered.

NOAA Activities:

NOAA was notified of this incident on July 24, 1997, by MSO San Juan who requested onscene support. The SSC coordinated scientific and technical input used for the response from NOAA HAZMAT, other NOAA resources, state agencies, other Federal agencies, local academia, salvors, and the ICS.

The SSC served as planning section chief for the USCG within the ICS. HAZMAT's information specialist filled the role of situation unit leader. NOAA also filled the role of technical specialists within the ICS with the members of the SST including a BAT member and a Chemical Assessment Team member.

NOAA provided potential oil trajectories that were updated as on-scene weather dictated.

NOAA provided on-scene weather forecasts for the area with the assistance of the NWS Predicted tides were provided daily.

NOAA HAZMAT's health and safety officer provided health and safety information related to PPE requirements and exposure concerns for the oil involved in this incident. NOAA provided information for local resources at risk and coordinated with other local trustees and stakeholders to ensure all resource concerns were identified. The BAT conducted biological resource evaluations on-scene to help establish protection recommendations and priorities. Additionally, pre-Shoreline Cleanup Assessment Team (SCAT) assessments were conducted to identify areas of turtle nesting and other response or shoreline cleanup issues. These surveys were conducted jointly with representatives from USFWS, Puerto Rico DNER, the RP, and the Environmental Equality Board.

NOAA conducted chemical analyses of the IFO 180 fuel oil for general characterization and to provide a screening test for dispersant applicability. NOAA provided an oil chemistry specialist on-scene to assist with dispersant application and monitoring issues in the event a spill occurred.

NOAA provided information management, distribution, and documentation assistance during the response and will provide the OSC a final documentation record of the incident on CD-Rom.

NOAA provided on-scene support from July 26 through August 1, 1997.

References:

Coastal Area Contingency Plan for Puerto Rico and U.S. Virgin Island
Corexit 9527 Technical Data Bulletin

CRRT Dispersant Use Plan and Letters of Agreement for Puerto Rico
Dispersant Application Observer Job Aid NOAA. 1993.

ADIOS™ (Automated Data Inquiry for Oil Spills) User's Manual. Seattle: Hazardous Materials Response and Assessment Division, NOAA. 50 pp.
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NOAA Hotline #235, 36 Reports Research Planning Institute. 1984. *Sensitivity of coastal environments and wildlife to spilled oil: Puerto Rico. A coastal atlas*. San Juan: Puerto Rico Department of Natural Resources. 35 maps.

SROMP Dispersant Monitoring Plan Torgrimson, Gary M. 1984. *The On-Scene Spill Model: A User's Guide*. NOAA Technical Memorandum NOAA OMA-12. Seattle: Office of Oceanography and Marine Assessment.
87 pp.

USCG POLREPS for the *Fortuna Reefer* Hotline #235 Incident

Name of Spill: M/V *Kuroshima*
NOAA SSC: John W. Whitney
USCG District: 17
Date of Spill: 11/26/97
Location of Spill: Unalaska Island, Alaska
Latitude: 53°55' N
Longitude: 166°25' W
Spilled Material: IFO 380
Spilled Material Type: 4
Amount: 47,000 gallons were released; 69,600 gallons were lightered to temporary storage
Source of Release: non-tank vessel
Resources at Risk: Habitat: salmon spawning in freshwater lake and feeder stream
Marine Mammals: sea otters, sea lions, and seals
Birds: gulls, eagles, murres, emperor geese, eiders, and other seabirds
Intertidal Community: sea urchins, mussels, chitons, limpets, etc.
Subsistence Use: Aleut native collection and consumption of invertebrates, some sea ducks, and edible plants
Recreation: Summer Bay Lake and beach are major summer recreation use areas
Cultural: archaeological site
Dispersants: Y
Bioremediation N
In-situ Burning: Y
Other Special Interest: unusual cleanup technique
Shoreline Types Impacted: coarse-sand and gravel beaches, exposed bedrock cliffs, exposed rocky shores, freshwater marshes, sheltered sandy beaches, sheltered rocky shores
Keywords: power washing units, weed cutters, salvage, in-situ burning

Incident Summary:

The Japanese cargo vessel, M/V *Kuroshima*, had been anchored outside Summer Bay near Dutch Harbor, Alaska for over 3 weeks waiting to take on fishery's cargo when a powerful storm hit on November 26. Northerly winds built to 40 to 50 knots with gusts up to 90 knots and seas of 28 to 30 feet. After dragging both anchors, the captain decided to weigh anchor and move the ship. Residents reported seeing the vessel pitching severely in the water starting the morning of November 26: "...from the front beach in Unalaska, we could see her stern rise so sharply as to expose her props and rudder." (The Dutch Harbor Fisherman, December 18, 1997).

The vessel broke anchor and ran aground near Second Priest Rock the afternoon of November 26. During the grounding, there were two fatalities. The ship ran aground on the beach in Summer Bay just west of the outlet of Summer Bay Lake, with the port side to the beach. The huge storm waves caused a surge that propagated up the stream channel, under the bridge, carrying oil all the way into the south end of the lake. A city of Unalaska employee obtained heavy equipment to build an earthen dike at the lake outlet to prevent more oil from entering the lake.

On March 1, 1998, salvors refloated the *Kuroshima*. It took three salvage companies three months to free the hard-aground vessel. After securing and cleaning the vessel, Crowley Marine Company, the original contractor, used shore-based excavators, a series of beachgear anchors, winches mounted on the *Kuroshima*'s deck, and the line pull from Crowley's salvage vessel *American Salvor*, to turn the *Kuroshima* 90 degrees and pull it several meters out to sea, before the contract with the ship owner expired on February 15. Smit Americas won the second salvage contract and succeeded in freeing the *Kuroshima* using two bargemounted excavators, the prop wash from several tugs to dig the vessel from the sand, and the *Kuroshima*'s anchor winch and engines. Substantial work was subcontracted to Magone Marine of Dutch Harbor. No pollution occurred during the salvage operation.

Behavior of Spilled Material

The spilled material was an IFO-380 oil, which is roughly 25 percent diesel and 75 percent Bunker C. The lighter component evaporated rapidly as evidenced by a petroleum aroma during the first week. During the initial release, nearly all the oil was driven onshore and deposited as very thick, viscous, stable mats and patches of mousse.

Chemical analysis by LSU revealed a very stable emulsion with a highly retarded weathering rate and pronounced wax component suggesting a strong similarity to oil classified as low-API gravity fuel oils (LAPIO).

The oil moved on the water for a week after the stream dike was breached, washing a considerable amount of previously beached heavy, thick mouse oil patches back into Summer Bay. A small additional leak from the vessel may have occurred during this period. Prevailing winds carried the oil offshore and to the north where it was blown ashore into Humpy and Morris coves and onto the intervening rocky headlands.

A small amount of the oil blown into Summer Bay Lake took on sand and sediment and sank to the bottom mostly along the northern portion and some in the southeast portions of the lake.

Thick stable mousse coated the perimeter of Summer Bay Lake, becoming matted into vegetation and then covered by frozen-over lake water. The heaviest oiling was at the southeast and northwest corners. Sunken oil patties observed under the bridge and on the bottom of the lake were confirmed after a spring diving survey. There were surface and buried oil layers 5 to 7 centimeters thick in sand at Summer Bay Beach.

Wild rye grass and sand surfaces on dunes were lightly oiled. A coat of oil up to several centimeters thick was seen on cut bank along a streamlet leading from lake to bay. Morris and Humpy coves and rocky shorelines east of Summer Bay had mats, tarballs, and oiled debris wash up on their beaches

Very important archaeological resources and sites exist near the spill. An important unexcavated early man/pre-Aleut dwelling location is in a dune valley near Summer Bay, just upland of the grounding. Large globs of oil were reported to have blown into and contaminated this site. There are also archaeological sites in Humpy Cove. These sites were not contaminated by the spill. An archaeologist from Anchorage worked under the FOSC and participated in the SCAT surveys of all areas containing archaeological resources.

Summer Bay Lake and the stream flowing into it are important anadromous fish spawning and rearing habitats for limited numbers of sockeye, pinks, dolly varden, and silver salmon.

Generally, the cleanup period from late November through May does not coincide with the active spawning period for these fish. As a result, impacts should be minimal, but that remains to be seen July 1998 reports indicate that salmon returns and fishing have been outstanding.

Less than 150 oiled birds were collected Of these, 18 were shipped live to Homer for rehabilitation, but only two survived. Oiled birds included eagles, gulls, murres, and other seabirds.

Countermeasures and Mitigation

Winter response progress is retarded by working in snow, ice, and high-winds. The cleanup of *Kuroshima* was interrupted on December 20 by cold weather and was not started again until April.

Cleanup at Summer Bay Lake involved manual removal with shovels, rakes, pitch forks, and clippers. There was minor mechanical cleanup and power washing in northeast and northwest corners of the lake. Divers picked up the sunken oil from the lake bottom with bags and hand implements.

Cleanup at Summer Bay beach was done by mechanical excavation and manual removal of surface and buried-oil layers with thermal treatment at formerly used defense sites (FUDS).

The oiled logs were removed and burned.

At Morris and Humpy coves and other rocky shorelines the oiled mats and debris were sacked and then transported to Oregon for disposal. More than 500 supersacks were filled and removed.

The oiled archaeological site at Summer Bay was not cleaned by the response workers. An agreement between the RP and the Unalaska Native Corporation was struck to provide funds to further excavate this site. Information provided to cleanup workers regarding procedures for archaeological sites and any artifacts found during the cleanup was very effective.

The RP established a full incident command system and had over 100 cleanup personnel working on the spill. ERST/O'Brien's was hired to manage the spill and Beak Environmental was hired to handle scientific and technical response questions including leading the SCAT team. Federal and State responders were fully integrated into this command structure, and despite differing roles, everyone worked as a team.

A temporary tank farm was established onshore to lighter the remaining fuel in the vessel.

Final lightering was not completed until two weeks after the incident because weather, wind, and tank clingage hampered lightering operations. There were 69,600 gallons of IFO- 380 pumped off the ship into the temporary tank farm.

No observations or reports of oiled marine mammals occurred.

Other Special Interest Issues:

An unusual cleanup technique involved taking advantage of a thermal treatment unit located in Dutch Harbor by the U.S. Army Corps of Engineers (USCOE) that has a contract for treating petroleum-contaminated soil from FUDS. Approximately 2000 tons of oiled beach sand were treated in this FUDS facility before returning the "cleaned" sand to Summer Bay beach.

NOAA Activities:

NOAA was notified of this incident on Thanksgiving Day, November 27, 1997, by the USCG. The SSC accompanied the first contingent of responders aboard a USCG C-130 to Dutch Harbor to respond to the *Kuroshima* oil spill. Within several days NOAA's support was augmented with an information manager and a member of BAT. From the onset to the winter stand-down on December 20, NOAA's support included:

Mapping the impacted shoreline areas.

Mapping floating oil and providing trajectories based on differing wind conditions.

Providing weather forecasts.

Establishing SCAT protocols and representation.

Meeting with land owners/managers including the Native Corporation and the City of Unalaska.

Providing chemical analysis of the fresh and beached oil.

Assisting NOAA Damage Assessment personnel sample subsistence resources in the rocky area immediately east of Summer Bay for chemical analysis.

Obtaining local knowledge regarding the use of the Summer Bay/Lake area for subsistence, fishing, hiking, skiing, bird watching, and other recreational purposes. Preparations were made during the winter to restart the cleanup around the middle of April. The largest NOAA effort continued into the spring as a member of SCAT. Over the winter several meetings were held with the RP-SCAT leader to finish forms, procedures, personnel, and methods for the spring startup. As the federal representative on the SCAT,

NOAA journeyed to Dutch Harbor during the first week in April to recommence the *Kuroshima* cleanup. For 10 days before the spring cleanup, the SCAT re-surveyed all the oiled shorelines and prepared work orders for all the oiled shoreline segments.

The dominant cleanup technique involved manual labor with shovels, rakes, and clippers, although minor amounts of mechanical, power washing, and in-situ burning of oiled debris were also used. More than 500 super sacks of oiled rock and debris were collected and shipped by barge to an Oregon hazardous waste disposal site.

Because the oiled areas were primarily public-use beaches, the cleanup standards were quite high. The SCAT acknowledged that the weathered Bunker C was not toxic and posed little threat to the environment. Instead, the standard followed was cleaning to a level where human visual and physical interaction with the oil had a very low probability.

This resulted in a very labor-intensive cleanup, and in some cases 10-man crews would complete only 30 feet of lake shoreline in a 10-hour working day.

NOAA also helped decide how to remove oiled sand from Summer Bay beach for thermal treatment and how to determine the optimum times for returning the clean sand to the beach to prevent major beach erosion. A small-scale test of "Sphag Sorb" indicated that it would still stick to the bunker C oil within the first few weeks after release. NOAA consulted with local plant experts, University of Alaska experts, and other plant ecology experts in Alaska regarding the Summer Bay Lake plant communities and their sensitivity to cleanup activity. Generally the plant community, dominated by wild rye grass, is fairly hardy and oiling of the dead shoots and stocks in the middle of winter would be fairly inconsequential. When the cleanup ended, abundant new growth and regeneration were already underway.

Final shoreline cleanup and SCAT sign off occurred the end of May; however, minor additional cleaning during the month of June was necessary because minor amounts of oil surfaced.

There were eight NOAA people on-scene for the *Kuroshima* response and at least that many supporting the cleanup from outside organizations. Other agencies on-scene with NOAA were the National Weather Service in Anchorage, the Auke Bay NMFS laboratory, and the Anchorage NMFS office.

References:

NOAA. 1994. *Shoreline Countermeasures Manual. Alaska.* Seattle: Hazardous Materials Response and Assessment Division, NOAA. 94 pp.

NOAA Hotline #264, 130 Reports

Name of Spill: M/V *NEW CARISSA*
Date of spill: February 4, 1999
Location of spill: 2.7 miles north of entrance to Coos Bay, Oregon
Latitude: 43°21.4' N
Longitude: 124°18.7' W
Spilled material: Type 2, Type 4
Amount: 360,000 gallons (60,000 spilled; 200,000 burned; 100,000 sank with vessel)
Source of spill: non-tank vessel
Resources at risk: sea lions, haulouts, diving coastal birds, shore birds (endangered); national park, national estuarine research reserve
Dispersants: no
Bioremediation: no
In-situ burning: yes
Other special-interest issues: in-situ burning; media interest; complex salvage operation; ESA issues
Shoreline types Impacted: sand/gravel beach, coarse/fine sand beach, tidal mudflats, marshes, fishery closure
Keywords: in-situ burning, salvage, endangered species
NOAA SSC: Sharon Christopherson
USCG District: 13

INCIDENT SUMMARY
The M/V *New Carissa*, a 639-foot bulk freight ship of Panamanian registry, arrived off the entrance to Coos Bay, Oregon, the night of February 3, 1999 during a strong ocean storm with high winds (39 knots) and 26-foot seas. Approximately 400,000 gallons of bunker fuel, diesel, and lube oil were on board. The vessel carried no cargo and was inbound to load a cargo of wood chips in Coos Bay. The Coos Bay pilot warned the vessel not to enter the bay until conditions moderated. The Captain of the *New Carissa* anchored the ship 1.5 nm offshore. During the night, the vessel dragged anchor and,

early on the morning of February 4, the *New Carissa* went hard aground about 150 yards off a sandy beach 3 miles north of the entrance to Coos Bay.

A Unified Command (UC) was established in Coos Bay with the Federal On-Scene Coordinator (FOSC), Oregon state on-scene coordinator (SOSC), and the Responsible Party (RP) represented by the spill management team Gallagher Marine Systems, Inc. The RP contracted Smit Americas as the salver. The UC called upon key federal, state and local agencies, stakeholders, and contractors to assist with the response. Before the incident ended, 58 different agencies and groups, and about 700 people, participated in the response. One storm after another came through the area during the four weeks following the grounding. Due to the constantly changing conditions and movement of the vessel in the surf zone, simultaneous planning efforts were initiated early in the spill to address numerous response operational options, including vessel salvage, protective booming of sensitive environments, lightering, in-situ burning, scuttling at sea, and shoreline cleanup. Given the viscosity of the oil and the shallow-water depth, dispersant use was deemed inappropriate.

Initial attempts to salvage the *New Carissa* were thwarted by severe winter storm conditions that trapped the salvage tug in Astoria and pushed the grounded vessel closer into shore. On February 8 the vessel began to leak oil due to structural damage. The salvage tug could not get close enough to hook up the towline. By February 10, the engine room flooded; fuel tanks, ballast tanks and cargo holds were compromised. The deteriorating condition of the hull and another severe winter storm warning led the insurance underwriters to declare the vessel a constructive total loss. The Unified Command, in consultation with the Regional Response Team, decided to burn the fuel on board the vessel rather than chance a catastrophic release of oil in the sensitive nearshore waters and Coos Bay. With the assistance of an U.S. Navy Explosive Ordnance Demolition Unit, the fuel was successfully ignited and burned for 33 hours. NOAA and the USCG PST coordinated monitoring of the smoke with local health officials. During the night, the vessel broke in half through the No. 5 cargo hold.

Inspection of the bow section after the burn indicated that approximately 200,000 gallons of fuel were consumed, leaving 100,000 gallons still on board. Over the next two weeks, attempts to lighter the remaining fuel to onshore Baker tanks failed due to the high viscosity of the oil and constant movement of the bow section in the surf line. The decision was made to tow the bow section 300 miles offshore and scuttle it in 12,000 feet of water. Given the viscosity of the oil and the temperature at that depth, the majority of the oil would be expected to remain trapped in the bow.

The bow was successfully rigged and refloated on March 1. After 3 days of pulling, the bow section refloated and was towed out to sea followed by the MSRC *Oregon Responder* spill-response vessel. Another storm was forecast offshore, but the expected conditions were considered within the capabilities of the tow. However, the storm intensified as it approached the coast. With the bow 50 miles offshore and 19 hours into the tow, high winds and 30-foot seas parted the chain connecting the tow cable to the tug, setting the bow section adrift again. The bow drifted at up to 7 knots on a north-northeast course. On March 3, 14 hours later, the *New Carissa* grounded on a sand beach just north of Alsea Bay in Waldport, Oregon.

The Navy supplied a new, 2,400- foot towline, but another storm delayed its rigging. The bow section was again refloated and towed out to sea on March 8. The bow section of the *New Carissa* was sunk by a joint effort of the USCG and Navy on March 11 in 1,811 fathoms 282 nautical miles off the Oregon coast.

The stern section remained grounded at Coos Bay. The USCG supervised the removal of an additional 14,000 gallons of an oil/water mixture and over 100 cubic yards of oiled debris using divers and helicopters for access. The RP tried to refloat and remove the stern section over the summer months, only to be thwarted by heavy surf and the deteriorating condition of the hull. A final, all-out effort at the end of the summer of 1999 succeeded in moving the vessel only a short distance out to sea, before another storm and high seas made it too dangerous to continue; following the storm, the stern had again been pushed back into the surf zone. On October 1, salvage attempts were discontinued for the winter.

BEHAVIOR OF SPILLED OIL

The *New Carissa* was carrying about 360,000 gallons of heavy refined products with an API of 13.6 to 20.8, in addition to 37,000 gallons of marine diesel with an API of 29.7. Because of the grounded vessel's location, oil was released directly into the surf zone during periods of high storm activity. Large slicks beached very near the accident site; all other shoreline impacts were in the form of small tarballs.

Wave-driven currents dominated the movement of oil released in the surf zone. During most of the time that oil was being released, the dominant wave direction was from the west-southwest to west, resulting in upcoast, alongshore currents. During the first few days after the grounding, a west-northwest wave direction and high winds resulted in a temporary southward flow to the alongshore current. Because of this southerly flow, some tarballs were seen in Coos Bay and on beaches immediately to the south. After the first few days, all environmental data and observational information confirmed a northward movement of tarballs. During periods of offshore winds, the tarballs could be seen moving offshore, outside of the breaking waves. As the tarballs moved farther offshore, they were more widely dispersed and more difficult to locate. The circulation off Oregon is part of the California Current. During this time of year, the northwardflowing Davidson Current inshore of the California Current could carry widely scattered tarballs as far north as Washington. Light, intermittent shoreline impacts were observed from Cape Arago to north of Waldport, Oregon.

Following the grounding of the bow of the *New Carissa* just south of the entrance to Waldport on March 5, oil was flushed out of the open section of the bow by surf action and stranded on the shoreline and adjacent mudflat. Transient concentrations of small, fresh tarballs and heavily weathered, larger tarballs were reported on widely spaced stretches of beach north and south of Waldport over the next several weeks.

Repeatedly, because of remobilization by high tide, concentrations of the smaller, fresh tarballs reported one day would no longer be present the next day. Small numbers of widely scattered, fresh tarballs were also observed stranded on shorelines inside Alsea Bay directly downwind from the bay entrance. In general, movement of the tarballs was to the north, with some moving inside of Alsea Bay during flood tides.

Quantities of oil that moved away from the spill site are difficult to determine. For instance, throughout the spill and all along the Oregon coast, diatom concentrations were mistaken for oil in water and on the beach. Based on observations early in the spill, about 10,000 gallons on the water surface were accounted for before the burn. The *New Carissa* breakup after the burn released about 50,000 gallons more of floating oil. In addition to the floating oil, some oil remained trapped on the vessel. Attempts at massbalance estimates varied, generally indicating that about 200,000 gallons burned and another 137,000 gallons remained onboard the vessel or were released. These estimates were clouded by uncertainty in visual data because of the rapid tarball formation, the uncertainty in the amount of oil that might have naturally dispersed due to the high surf conditions, and the uncertainties associated with burn-rate information.

The effective in-situ burn time of the fuel onboard the vessel lasted about 33 hours. After that, and during preparations for towing the vessel out to a scuttle site, no significant amounts of floating oil were observed. Trajectory analysis was considered in the selection of a scuttle site. The northward-flowing Davidson Current inside the shelf break (~50 miles) and the southward-flowing California Current offshore of this, could lead to oil impact either north or south during the towing operation if significant amounts of oil were lost. The dominant winds during February are from the south. At about 200 miles offshore, oil lost would be under the influence of a weak, southwardflowing California Current and opposing winds. Based on this and the distance offshore, trajectories indicated that the oil would be so widely scattered by the time shorelines could be impacted that it would not be noticeably above the background tarball levels.

SHORELINE IMPACTS

The only observed heavy shoreline impacts were in the immediate vicinity of the stranded bow section during the several days following the in-situ burn. Large mats of oil were observed at high tide. Further north of the vessel, oiling was intermittent along the beach, especially following periods of onshore winds. The impacts typically consisted of accumulations of small, sticky tarballs in the surf zone and along swashlines. If not picked up, these tarballs were frequently refloated by the next high tide. A smaller number of larger tarballs, even tar patties, were sometimes observed as well.

These larger tarballs were frequently observed to be more weathered, and tended to incorporate significant quantities of sand and vegetation material. The tarball impacts continued throughout the spring, but began to significantly decrease once the *New Carissa* bow section was refloated and towed out. By June, all beach segments had been signed off except those immediately north and south of the still remaining stern section. Trace amounts of tarballs were observed intermittently on these sections throughout the summer while lightering and salvage activities continued on the stern.

These segments were finally signed off by the Unified Command in January 2000. Shoreline impacts following the grounding of the *New Carissa* bow in Waldport on March 5 were significantly lighter. Heavy surf flushed the broken section of cargo hold No. 6, causing light to moderate tarball impacts in the immediate vicinity of the bow, as well as intermittent patches of light tarball oiling along the northern coast. Some tarballs were flushed into Alsea Bay, resulting in intermittent light impacts on marshes east of the bay entrance.

RESOURCES AT RISK

Initial grounding

The initial grounding and release off the entrance to Coos Bay potentially affected a number of sensitive habitats and resources. Coos Bay itself is a shallow-water estuary containing large areas of sheltered mudflats, shellfish beds, and nursery areas for fish and shellfish species. Other sensitive estuarine areas located north of Coos Bay were within the potential impact area from a catastrophic release, including the Umpqua River, Siltcoos River, Suislaw River, and numerous small coastal creeks and inlets. The Oregon Dunes National Recreation Area is located on the north spit in Coos Bay. The dune structure is particularly vulnerable to human activity involving heavy vehicle or equipment traffic. South Slough National Estuarine Research Reserve is located at the south end of Coos Bay.

•**Marine mammals** Northern sea lions, California sea lions, and harbor seals are present throughout the area, with a major haulout and pupping site for the Northern sea lion located just south of Coos Bay at Cape Arago. Northern elephant seals are also found in the vicinity of Cape Arago.

•**Birds** Birds normally present in the coastal waters at this time include gulls, some shorebirds, scoters, scaups, loons, and bald eagles. Shorebirds feeding along the tideline, including plovers, sanderlings, snowy plovers, sandpipers and dunlins, were more likely to be impacted by stranded oil. Of particular concern were wintering colonies of Western snowy plover. This federally threatened species feeds in the swash zone of coastal sandy beaches, and typically uses sand spits, dune-backed beaches, unvegetated beach strands, open areas around estuaries, and beaches at river mouth as preferred coastal habitats for nesting. A small colony of snowy plovers was known to be present 300 yards south of the vessel, but these habitats were common throughout the potential impacted area. Biologists identified a number of other specific snowy plover concentration areas to monitor during the response. Migratory snowy plovers also began arriving in the spring to establish nests. Coastal offshore birds foraging in the area included cormorants, murres, auklets, gulls, and puffins.

•**Fisheries** Coos Bay and the Umpqua River are important estuaries for outmigrating salmon (chinook and coho). Juveniles begin outmigration in March; chinook juveniles are especially vulnerable because they may spend weeks in the estuary before entering the ocean. Both estuaries also contain Pacific herring. Shellfish such as Dungeness crab, razor clams, and mussels are present along the outer coast north of the grounding site. Important recreational and commercial clam and oyster beds are found throughout Coos Bay, especially in South Slough. Clams and Pacific oyster are also abundant in the Umpqua River estuary
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Re-grounding of bow section at Alsea Bay.

The second grounding of the bow of the *New Carissa* occurred on a sand beach just north of the entrance to Alsea Bay. The entrance to Alsea Bay is composed of riprap structures and a large, exposed tidal flat in front of the riprap along the southern side of the bay. Alsea Bay, and Yaquina Bay, located 15 miles further north, contains extensive sheltered tidal flats and marshes. The Yachats River, a smaller estuarine area, is 10 miles south of Alsea Bay. The outer coast shoreline from the grounding site north to Yaquina Head consists of stretches of sand beaches alternating with wave-cut platforms with scattered offshore rocks.

•Marine mammals Seal Rocks State Park to the north is a major haulout for harbor seals and Northern sea lions. California sea lions are also in the general area. Harbor seals congregate in and haul out on the tidal flats in Alsea Bay.

•Birds The sand beach north of the grounding site is western snowy plover habitat. Seal Rocks is a site for nesting gulls, black oystercatcher, and pigeon guillemot. Yaquina Bay is important bird habitat, particularly the south area, where cormorants, gulls, sandpipers, snowy plover, and pelicans concentrate. Large numbers of migrating marine birds and shorebirds were expected to start passing through the area soon.

•Fisheries Alsea Bay and the Yaquina River are important estuaries for outmigrating salmon (chinook and coho). Juveniles begin outmigration in March; chinook juveniles are especially vulnerable because they may spend weeks in the estuary before entering the ocean. Both estuaries contain Pacific herring and Yaquina Bay also contains steelhead trout. Shellfish such as Dungeness crab, razor clams, and mussels are present along the outer coast north of the grounding site. Recreational and commercial clam and oyster beds are in Yaquina Bay. There was a greater risk of oil reaching the bay habitat following this grounding, since the grounding site was so close to Alsea Bay. Fortunately, only a small quantity of oil entered the bay.

COUNTERMEASURES AND MITIGATION

•Protection of Sensitive Areas The Northwest Area Plan's Geographical Response Plans (GRP) for Coos Bay and the southern Oregon coast have identified specific booming protection strategies to protect priority sensitive environmental resources in the event of an oil spill. Prior to any oil being released, the environmental unit of the planning section worked closely with the Operations Section to identify which of these protection strategies needed to be deployed. Using the NOAA trajectory analysis for a catastrophic spill, the decision was made to implement strategies for any sites that might be impacted within 12 hours of a spill. Equipment for strategies protecting areas that might be impacted within 24 hours of a spill occurring was pre-staged near the specific site to ensure rapid deployment if necessary. Over 10,000 feet of protective booming was deployed within the first 10 days of the response. The same process of identifying and deploying GRP strategies was followed when the *New Carissa* bow regrounded at Waldport on March 5. As a result of our experiences during the *New Carissa*, a number of the Oregon coastal inlet protection strategies were modified in the GRP to reflect what we had learned about deployment under severe storm and surf conditions. One of the issues raised both during and after the response was the lack of strategies to adequately protect commercial oyster and clam beds in the expansive shallow mudflats of Coos Bay and other estuaries with the response technology available to us at this time. This issue highlights the importance of preventing spills and/or keeping oil out of estuarine areas.

Throughout the response, the environmental unit and operations section cooperated closely to minimize the potential for response activities causing any additional environmental impacts, especially in area where the Western snowy plovers were foraging or nesting. Specific guidelines limiting vehicle access, overflights, or requiring biologists to accompany cleanup crews were developed for specific sites in the response zone. The environmental unit also ensured that a biologist was made available to operations for those sites when needed. These guidelines were included on the sitespecific response workplans, as well as graphically on the daily situation update maps.

•Initial salvage and lightering attempts The *New Carissa* ran aground during a severe winter storm. The waves were too high to bring a vessel alongside to lighter and the closest salvage tug, *Salvage Chief*, with sufficient bollard pull was 200 nautical miles away in Astoria. By the time the *Salvage Chief* was mobilized to head for Coos Bay, the Columbia River bar in Astoria was too rough to cross. On February 8, the *New Carissa* began losing oil from the vicinity of the Nos. 1 and 2 fuel tanks. By the time the bar calmed and the *Salvage Chief* arrived on scene on February 9, the *New Carissa* had been blown closer to the shore. The water was too shallow under the existing sea conditions for the *Salvage Chief* to get close enough to her to pass a line. The ship's crew and salvage master were monitoring the vessel's condition on February 9 and expecting another Pacific storm to push in. Inspection confirmed that four of the six cargo tanks were compromised; 4 ballast tanks were also holed. With the impending arrival of another winter storm, the continuing deterioration of the vessel's hull, and the potential for a catastrophic release in the nearshore waters outside of Coos Harbor, the Unified Command began to consider in situ burning as a response option. The morning of February 10 the engine room was taking on water and a 20-ft long transverse crack was discovered in cargo hold No. 6. The vessel's insurance underwriter declared the vessel a constructive loss. After consultation with the Regional Response Team, the decision was made to burn the fuel on board.

•In-situ burning The decision to burn the fuel was based on the continuing deterioration of the vessel's integrity, the high winds/seas forecast, and the potential for releasing a large volume of oil into Coos Bay and sensitive nearshore areas of the Oregon coast.

An USCG naval architect worked with an U.S. Navy Explosives Ordnance Disposal (EOD) unit from Whidbey Island, Washington to identify where to place explosives to ignite and sustain the "burn." An initial attempt to ignite the oil failed, but on February 11, the Navy EOD team used 400 pounds of explosives to rupture the fuel tank tops and a napalm mixture to help ignite and sustain the burn. The fire burned 33 hours and successfully consumed about half of the ship's fuel load. When the burn died out, an estimated 130,000-155,000 gallons of fuel remained onboard. Pounded by the surf, the ship split into two pieces during the burn, just forward of the No. 6 cargo hold bulkhead.

These sections began to drift apart in heavy waves and wind. All additional attempts to re-ignite the remaining oil in the bow failed.

To address the potential threat to public safety from the smoke plume generated from the in-situ burn, air monitoring for smoke particulates was conducted jointly by USCG, NOAA, and the U.S. Environmental Protection Agency (EPA). The SMART (Spill Monitoring for Advanced Response Technologies) protocols developed jointly by USCG, NOAA, EPA, and the USHHS Center for Disease Control guided the monitoring program. Monitoring was conducted at three locations in the vicinity of the predicted smoke plume: Empire, North Bend (near the airport), and Umpqua River CG station. The monitors were in place well ahead of the initiation of the burn to collect particulate data before and after. None of the readings exceeded background levels.

•Disposition of the Bow Section A survey of the bow section following the in-situ burn found that a significant quantity of fuel (approximately 100,000 gallons) remained in

Tank No. 3, with a lesser amount in the cargo hold above Tank No. 2. Although the explosives had breached the Tank No. 3 top, the oil had not spread out in the cargo hold where it could be more effectively burned. The remaining fuel onboard the bow still posed a significant threat to the environment. The Unified Command considered several options for removing the bow. Given the sensitivity of the adjacent shoreline, the high seas/surf action where the vessel was located, landside removal was not deemed feasible. Due to the concerns over the pollution and possible navigational safety threat posed by the bow section, the responsible party could not find a port that would permit the bow section to transit their jurisdiction to reach a repair/scrapping facility. The Unified Command, in consultation with the RRT, decided to tow the bow 200 miles offshore and scuttle it in deep water. Smit Americas ordered a special towline, 700-m long and 9.1-inch diameter, from the Netherlands.

While waiting for the towline to arrive and completion of the hook-up preparations, an attempt was made to lighter some of the fuel from Tank No. 3 to Baker tanks staged in the foredune area. The bow section was constantly being shifted by the strong wind and seas, and had moved within 300 yards of the beach. The bow section had moved close enough to the shore to make lightering logistically possible. The bow was fairly stable during low tide, but still had a tendency to move around during high tide. An opening was cut in the side of the vessel to allow viscous oil pumps and hoses to be staged. The Pacific Strike Team (PST) rigged the hoses up to a series of Baker tanks that had been staged on top of the dunes. This staging was very difficult; once during the preparations, a storm stranded the pumping crew onboard the bow overnight. Over a two-day period, the PST pumped 140,000 gallons of oil/water mixture. Unfortunately, due to the oil's viscosity (similar to cold peanut butter or soft asphalt), most of the collected fluid was water. Lightering operations were discontinued on February 22 when the special towline arrived on-scene.

Because of strong winds and heavy seas, it took three days for the helicopter to deploy the two ends of the towline to the bow and the tug *Sea Victory*. Once the towline was attached, it took 3 more days of pulling before the bow section broke free from the shore.

On March 1, the bow was towed out to sea followed by the MSRC *Oregon Responder* spill-response vessel. Another storm was forecast offshore, but the expected conditions were considered within the capabilities of the tow. However, the storm intensified as it approached the coast. With the bow 50 miles offshore and 19 hours into the tow, high winds and 30-foot seas caused the chain connecting the tow cable to the tug to part and set the bow section adrift again. The bow drifted at up to 7 knots on a north-northeast course. On March 3, 14 hours later, the *New Carissa* grounded on a sand beach just north of Alsea Bay in Waldport, Oregon. The bow section was again refloated and towed out to sea on March 8. The bow section of the *New Carissa* was sunk by a joint effort of the USCG and Navy on March 11 off the Oregon coast.

•**Lightering and salvage attempts on the stern section** The stern section of the *New Carissa* remained aground in the surf zone just north of the entrance to Coos Bay after the bow was successfully removed. Although most of the oil onboard the stern section was believed to have already leaked or burned, the FOSC determined that enough oil remained on board to pose a threat to the environment. During the summer of 1999, a concerted effort supervised by the USCG was made to open up and remove as much oil as possible from the 20+ day tanks, reservoirs, crankcases, piping, etc. associated with the wreck. The oil was recovered from the engine room by passive absorption, or skimming and pumping directly to temporary storage tanks for removal from the vessel. At the request of the FOSC, the Regional Response Team approved the use of the chemical Cytosol™ to help clean under the heavily coated decks and bulkheads within the submerged engine room. By the end of June, about 14,000 gallons of an oil/water mixture and over 100 cubic yards of oiled debris were removed from the stern section. The responsible party continued to efforts to refloat and remove the stern section. These attempts were complicated by the heavy surf, a significant quantity of sand that had collected in the engine room, the presence of numerous cracks and openings that needed repair, and hazardous sections of piping, derricks, and decking that remained attached to the stern. The superstructure was cut away and numerous cracks in the hull repaired.

A final all-out effort at the end of the summer of 1999 succeeded in moving the vessel only a short distance out to sea, before another storm and high seas made it too dangerous to continue; following the storm, the stern had again been pushed back into the surf zone. On October 1st, salvage attempts were discontinued for the winter. The stern continued to deteriorate over the winter, and in the spring of 2000, the salvers notified the State of Oregon that salvage from the water was no longer a possibility.

•**Cleanup** Skimming of floating oil was largely ineffective during the *New Carissa* response because of the location of the vessel in the surf zone. Oil discharged from the vessel was rapidly dispersed and/ mixed into the water column. In addition, the viscosity and the pour point of the heavier fuel oil resulted in rapid formation of tarballs, which made the oil very difficult to track.

The primary cleanup method throughout the response was manual pick up of stranded oil using shovels and rakes. A significant oil mat several inches thick and 100 m long with a similar buried layer underneath was manually removed from the shoreline immediately north of the wreck following the in situ burn of the fuel on board and the breaking of the vessel into two sections. Tar patties weighing up to 50 pounds were found infrequently and recovered over a number of months. For the most part, especially after the bow was refloated and removed, cleanup consisted of removing patches of very small tarballs accumulated along the swashlines by a falling tide and onshore breezes. In June, the USCG completed oil recovery operations on the stern section. All shoreline segments, with the exception of the two immediately adjacent to the stern wreck, had been signed off by the Unified Command.

Daily monitoring of these two beach sections continued until the end of the summer while attempts to remove the stern continued. Observations were documented on a standardized Beach Assessment Reporting Form. This ensured that any oil released or mobilized from the sediments by salvage operations would be removed. Due to the nesting and fledgling activity by Western snowy plover in the area, even small quantities of oil were removed when observed. Quantities of oil collected typically ranged from ounces to a few pounds, with only occasional incidents of larger quantities being found.

These final two beach segments were signed off by the Unified Command in January 2000.

•**Oiled wildlife recovery and rehabilitation** On February 8, as soon as oil started to leak, the U.S. Fish and Wildlife Service (USFWS) and the Oregon Department of Fish and Wildlife (ODFW), in cooperation with the Responsible Party, set up a wildlife response and rehabilitation mobile facility on the east side of North Spit in Coos ay.

The International Bird Rescue and Research Corporation was mobilized. Spill response efforts included trained wildlife survey teams to recover dead birds, report live oiled birds for recovery and rehabilitation, and census bird populations at risk. On March 3, when the bow section grounded near Waldport, a second wildlife rehabilitation facility was set up there. During the primary response, approximately 1500 birds were collected. Of these, 133 oiled birds (mostly sanderlings, cormorants, and scoters) were treated and released. Seventeen oiled snowy plovers were treated and released. Less heavily oiled birds observed in the field were not routinely collected for rehab, since they were very difficult to capture and the stress induced from handling could be more harmful. USFWS, ODFW, and NOAA conducted field surveys to identify bird and marine mammal populations at risk and the percent of the population that was oiled.

This information was used to determine the intensity and duration of wildlife recovery and rehabilitation activities.

OTHER SPECIAL-INTEREST ISSUES

• Snowy plover response restoration activities initiated during active phase of response.

The trustees negotiated several emergency-phase restoration activities within the snowy plover habitat areas that were initiated while the active response was still in progress. These activities included fencing nesting sites to better protect the chicks, monitoring the occurrence of tarballs in snowy plover habitat areas, reduced public access, and assignment of a trained biologist to accompany cleanup and survey teams into critical habitat areas to minimize disturbance of the birds. This helped ameliorate some of the early impacts to the population by improving the birds' chances of successfully breeding and thereby hopefully improving natural recovery of the population. This did lead to confusion by several agencies about which were response actions and which were restoration, especially relative to expectations for beach cleanup and sign-off criteria.

Early restoration activities concurrent with active response should be considered when a highly sensitive or vulnerable resource is at risk or the incident is likely to last for an extended period of time. Consideration must, however, be given to the effect of the restoration activity on response activities to ensure that response is not unduly hampered, increasing impacts to resources of concern by delaying response efforts.

• The *New Carissa* was the first incident in the lower 48 states involving intentional in-situ burning of bunker fuel in a vessel. Intentional in-situ burning of fuel on stranded vessels has been used as response option in Alaska and other remote areas where it was not possible to lighter or salvage the vessel. The *New Carissa* was the first incident where this option was utilized in the more populated lower 48 states. The four to seven-day sequence of repetitive violent winter storms passing through the area created such high winds and surf that access to the vessel was extremely limited and then only by lowering personnel and equipment from helicopters. No support vessels could be brought in next to the *New Carissa*. The vessel’s steadily deteriorating condition made the risk of a catastrophic oil spill in the extremely sensitive nearshore waters and adjacent Coos Bay estuary appear imminent. On February 11 half of the vessel’s cargo was successfully burned. This operation followed the existing in-situ burning policy in the Northwest Area Plan. However, this policy dealt primarily with in situ burning of oil on water contained by a fire-resistant boom. A number of operational and coordination issues had to be addressed during this incident that had not been covered by the existing policy. These lessons learned are now being incorporated into the Northwest Area Plan and have sparked a number of regional and national dialogs on topics. These topics include coordination of salvage and spill response activities, in-situ burning operational support and existing USCG/USN Memoranda of Agreement, and coordination with community and state health officials for in-situ burning operations that cannot be readily extinguished if the wind shifts.

NOAA ACTIVITIES

The NOAA Scientific Support Coordinator and Scientific Support Team were activated by the Federal On-Scene Coordinator on February 4 and requested to go on scene. The NOAA Scientific Support Team for this incident was made up of personnel from the Office of Response and Restoration, National Weather Service, National Marine Fisheries Service, and NOAA support contractors. Over the course of the response, they provided technical information to help guide response operations; coordinated with a wide spectrum of stakeholders and facilitated the development of consensus recommendations to the FOSC and Unified Command; participated in field surveys, overflights, and beach inspections; helped public affairs staff in press conferences, town hall meetings; and developed and maintained an incident-specific public web page.

During the first 6 weeks of the response, NOAA provided 234 person-days (1,874 hours) of on-scene and 101 person-days (814 hours) in Seattle and satellite offices in direct support of the *New Carissa* spill response. After demobilization, NOAA continued to provide intermittent field and technical support to the FOSC over the next 10 months dealing with issues of “how clean is clean,” beach inspections, and final shoreline signoffs.

•**Technical Information Support** The NOAA Scientific Support Team was an integral part of the Incident Command System (ICS) Situation Unit, routinely providing sitespecific weather forecasts, tidal height information, spill trajectories, overflight information, information on oil weathering and behavior, oil mass balance, and resources at risk. NOAA developed an array of maps and graphical products illustrating operational and environmental information summaries, including daily operational status of response and salvage activities; location of response equipment; flight restrictions; overflight maps of oil; shifting position of the stern and bow sections over time; trackline of salvage tug and bow en route to scuttling site; shoreline oiling and cleanup status; location of sensitive environments and site specific operational restrictions. NOAA also produced a series of base maps to be used by field personnel doing response and wildlife surveys. NOAA also established an initial system to track and document SCAT survey information being collected.

Prior to any release of oil into the water, NOAA provided statistical trajectory analyses for a several different scenarios. One analysis assessed the maximum distances that oil could travel in the first 6, 12, and 24 hours following a catastrophic release. This information was used to prioritize protection-booming strategies and whether boom needed to be deployed or need only be staged at the site. A second analysis compared the potential impact zones if the source (vessel) was moved from its current position to

25, 50, or 200 miles offshore. This information was used to help evaluate the environmental trade-offs of the in-situ burning and scuttling options.

NOAA provided smoke-plume estimates to assist in planning for the anticipated burn of the vessel's contents. Ground-level particulate concentrations were estimated using weather forecasts, special vertical mixing predictions from the National Weather Service (NWS), estimated burn rates from on-scene experts and discussions with A. Allen of SpillTec, modeling assistance from the NOAA National Institute for Standards and Testing (NIST) using the ALOFT model, and the NOAA In-situ Burn Calculator™. This information was then used to identify a "window" in which in situ burning could be safely done and help identify downwind airborne particulate monitoring sites.

NOAA was also requested to provide a recommendation to the FOSC on establishing a safety zone around the vessel for the in-situ burning operation. Using empirical data, potential fragment distribution from an explosion was estimated to be less than a kilometer. After consideration, the UC designated a safety zone of 1 mile around the vessel.

NOAA also provided information to representatives from the Oregon Department of Agriculture regarding oil impacts on shellfish and lessons learned from other spills in deciding when to close or open a fishery.

NOAA was asked to assist in discussions on "how clean is clean" before the final signoff of beach segments closest to the wreck of the stern in the late summer. There was no baseline data on the West Coast shoreline tarball concentrations. NOAA reviewed selected literature and interviewed researchers active in the field to develop a table summarizing tarball concentrations observed along the West Coast, especially in areas where Western snowy plovers and/or shorebirds were known to be present. When available, concurrent observations of numbers/condition of shorebirds were included. This information was summarized in a spreadsheet as grams of oil per linear feet of beach, and could then be compared to tarball survey information collected for the *New Carissa.*

•Field Activities NOAA personnel participated in daily overflights to determine the extent of spill and collect information for the trajectory monitoring. After the initial release of oil, the NOAA Scientific Support Coordinator participated with Coast Guard and Oregon State representatives on a shoreline assessment and jointly developed initial cleanup recommendations. NOAA accompanied shoreline branch personnel on beach surveys to confirm the feasibility of protection strategies and recommend appropriate cleanup techniques for specific shorelines.

The NOAA SSC represented the FOSC on the official shoreline signoff inspection team. This team consisted of 6-7 representatives from the Unified Command, resource trustees, and land managers whose property had been impacted. This team inspected each oiled beach segment after it was cleaned and provided a recommendation to the Unified Command whether the segment should be signed off or further cleanup was needed.

The question was raised of whether significant quantities of oil might have been mixed with the sand in the surf as a result of the turbulence generated during the numerous storms impacting the *New Carissa* during February. The concern was if such areas of oiled sediment were present in the nearshore area, at the end of the storm season when sediment processes changed from net erosion to net deposition, large quantities of oil might be transported back up onto the shoreline. Several attempts to sample for oiled subsurface sediments were all negative. At the FOSC's request, NOAA developed guidelines for a post-deposition transition survey of beach segments where the heavier oiling had occurred in Coos Bay and Waldport. These inspections involved systematic trenching in depositional areas on these beaches, and were carried out by the shoreline signoff inspection team in May. There was no evidence that oil was being remobilized and deposited or buried on the beaches.

A marine mammal expert from NMFS National Marine Mammal Laboratory participated in overflight surveys to help assess risk to marine mammal haul-out and concentration areas. These surveys found no evidence that would require setting up any collection/rehabilitation facilities.

•**Stake-holder Coordination** The SSC worked with the trustee stakeholders to identify environmental issues to be addressed by the response and provide consensus recommendations to the Unified Command. Members of the environmental unit at the *New Carissa* response included personnel from Oregon Fish and Wildlife, Oregon Parksand Recreation, DOI Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Forest Service, Oregon Dunes National Recreation Area, and the South Slough National Estuarine Research Reserve.

The NOAA Scientific Support Coordinator was the Environmental Unit leader at the start of the spill. This is the unit within the Planning Section that addresses environmental issues related to response operations for the Unified Command and highlights the environmental issues that need to be addressed in a response. Members of the environmental unit at *New Carissa* included personnel from Oregon Fish and Wildlife, Oregon Parks and Recreation, DOI Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Forest Service, Oregon Dunes National Recreation Area, and the South Slough National Estuarine Research Reserve. Through their individual expertise, local knowledge, and agency contacts, they were able to develop protection priorities; streamline permit requirements for activities in protected areas, and recommend cleanup methods that minimized environmental impact.

The Environmental Unit mapped sensitive resources, identified protection strategies, and reviewed contingency lightering options. The Environmental Unit helped the Operations Section get a plan approved that improved beach access for removing oil wastes from the beach as long as the access points were restored to their original conditions to minimize recreational access to the dune areas.

NOAA helped develop guidelines for reaching a consensus on recommending to the Unified Command that a shoreline segment be signed off as requiring no further cleanup.

Reaching this consensus was particularly difficult, since a number of the members were proposing a "zero tolerance" for any oil remaining on the shoreline. This was not considered technically feasible by a number of responders and biologists with extensive spill experience. A compromise position reached stated that cleanup was complete when, in the "best professional judgment of the shoreline signoff inspection team, no environmental benefit would be gained from further cleanup activities." The shoreline signoff inspection teams were able to reach consensus on all but a few shoreline segments. When consensus could not be reached, a majority recommendation was forwarded to the Unified Command with an explanation of the issues in contention.

NOAA SSC coordinated with biologists, AT&T cable personnel, and undersea volcano researchers for selection of towing path for the bow section to minimize possible environmental effects if the vessel were to sink en route to the scuttling site
NOAA SSC chaired evening science meetings at the command post. The SSC provided a brief overview of the status of the response and what issues were currently being worked. The format of the meeting allowed each SCAT or wildlife field team to give a short debrief on the day’s results, and bring up new concerns and issues relative to the response. This allowed the SSC to either address the concerns/issues raised, or forward them to the appropriate ICS section. It also allowed the NOAA SSC to ensure that scientific studies being conducted by various agencies and researchers in the spill area were coordinated with response operations to ensure no conflicts with response activities

NOAA met with the director of the Oregon DEQ and the local, county, and state health officers to answer specific questions on in-situ burning, and smoke plume composition and behavior shortly after the decision to conduct in situ burning. The original announcement initially raised a number of public health concerns with local health and state agencies. A NOAA industrial health expert with in- situ burning experience described the potential health effects and compared them with similar exposures to slash fires. He facilitated a discussion that weighed the potential threats to public safety against the environmental threats that were expected if the vessel broke up and released 400,000 gallons of oil into the nearshore area off Coos Bay. NOAA also worked with the Coos County Health Officer in developing steps the public could take if exposed to short periods of smoke. This coordination was especially important because, once the burn was initiated, it would be impossible to shut the burn down if the wind shifted. Recommendations for “sheltering in place” and voluntary relocation of those who desired it were worked out jointly with the County Health Officer and communicated to the local government.

NOAA SSC coordinated chemical sampling of oil with a number of state, trustee and responsible party groups. Confusion in clearly identifying which samples to use for source characterization had resulted because of problems in sampling, as well as the fact that a number of labs with different protocols were being used. The NOAA SSC facilitated dialogue among all the players on techniques, samples collected, and helped the group reach consensus on what would be used for source comparison.

•**Public Outreach Activities** NOAA helped develop technical fact sheets, briefing packets, maps, and graphics for use by the Joint Information Center. A list of frequently asked technical questions was also prepared to assist the JIC in telephone interviews and questions from the public. Members of the Scientific Support Team routinely participated as technical experts in press conferences, public meetings, and local government briefings.

The Coast Guard established a public website to provide response-related information to the public, other agencies, and the media. Its capacity was quickly exceeded and the Unified Command requested NOAA to maintain a site with sufficient capacity to handle this large of an incident. Within 24 hours, the website was built and posted. It was used not only for press releases, but also for Unified Command decision memos, pollution reports, technical reports, maps, and photos. The site was maintained until the end of August and received over a million “hits”.

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